

Arlington Reservoir Master Plan

2018

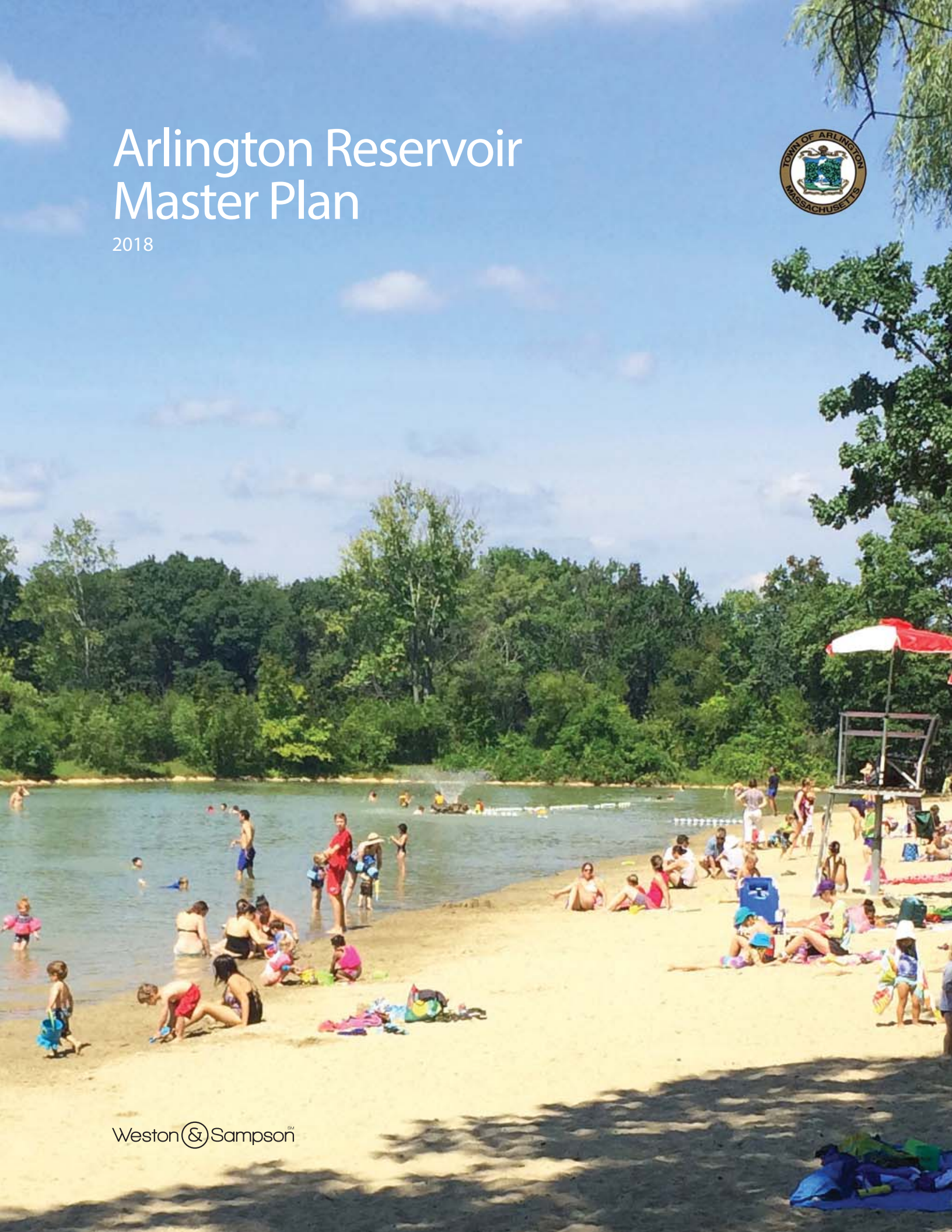


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We gratefully recognize the Town of Arlington's dedicated Reservoir Working Group that includes Jon Marshall, Director of Recreation; Lela Shepherd, Environmental Planner/Conservation Agent; Susan Chapnick, Chuck Tirone, and David White of the Conservation Commission; Ann LeRoyer, Master Plan Advisory/Implementation Committee and Open Space Committee member; and Leslie Mayer, Don Vitters, and other members of the Park and Recreation Commission. All of these dedicated people participated in aspects of this comprehensive master planning effort. As key aspects of the master plan are implemented in the coming years, their commitment to the Arlington Reservoir will result in benefits to all seeking recreational outlets and opportunities, as well as resource conservation.

We also wish to extend our gratitude to the many members of the community who came out for the open forums and expressed their thoughts and insights in person and to the many representatives of other Arlington town departments and committees for their sound advice and thoughtful direction. Thanks also to the Town of Lexington for providing both information and guidance as our work progressed. The recommendations contained in the Arlington Reservoir Master Plan represent our best professional judgement and expertise tempered by the unique perspective of the participants in the process.

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Weston & Sampson

April 2018

Adam Chapdelaine, Town Manager
Reservoir Working Group
Park and Recreation Commission
Conservation Commission
Vision 2020 Reservoir Committee
Department of Public Works
Open Space Committee

INTRODUCTION AND EXECUTIVE SUMMARY

Weston & Sampson was retained by the Town of Arlington in the fall of 2017 to complete a comprehensive master plan for the Arlington Reservoir (locally called 'The Res'). The purpose of this master plan is to develop a reservoir improvement plan that reflects the needs of a diverse and densely populated community. This plan will serve as a guide for all future development of this open space resource as well as become a tool to strategize for funding opportunities.

The scope of work undertaken by Weston & Sampson included:

- Carefully review, evaluate, process and validate the extensive prior planning concepts completed by various stakeholder groups including the Institute for Human Centered Design (see document included within Appendix I).
- Complete a land survey to determine exact boundaries of the Town of Arlington owned land. See plan provided in Appendix J.
- Assess water quality, water inflows and outflows, habitat for aquatic animals and water birds.
- Identify measures to control shoreline and bank erosion, while providing controlled access to the water for fishing and other activities.
- Undertake a robust public engagement process in order to solicit new public input, foster dialogue and build consensus.
- Establish a compelling preliminary and final master plan, to be validated, refined and endorsed through public dialogue.
- Establish a final preferred plan that is reflective of the physical capacity of the property and the Town's ability to operate and manage the property going forward.
- Establish a strong and achievable implementation and funding strategy with prioritized phases of improvement.

Over the past several months, representatives from the Town, its Reservoir Working Group and Weston & Sampson developed conceptual plans and a final "preferred" master plan for The Res property. These were generated in response to the needs of the Town as expressed by various stakeholders and community members at a series of public meetings. At the outset of the process, and in conjunction with the master planning work, Weston & Sampson representatives frequently toured the property at different times of day in order to assess the existing conditions of all active and passive recreation facilities, current limitations, safety and maintenance issues. Representatives identified the potential to provide new and refurbished facilities and an improved user experience. Existing conditions assessments are included within this document in the form of photographs, plans and narrative summaries.

On April 3, 2018, the final master plan was presented to the Park & Recreation Commission for acceptance. This written report represents the culmination of the master planning process and contains narrative and graphic depictions with descriptions of potential improvements, phasing scenarios, implementation strategies and maintenance considerations. New and refurbished facilities have been identified to meet the needs of various programs and activities. Additional improvements promote environmental stewardship and create new pedestrian linkages between various site facilities, improved parking and site access, and an improved trail system to establish The Res as a first-class park and recreation facility. Implementation of the improvements outlined herein will require significant resources. The Implementation Strategy section of the report identifies a phasing strategy and how the significant financial requirements of the master plan can be broken down to fit within the Recreation Department's annual capital budget and other funding sources to create a financial package that will support the project.

It is important to note that a "master plan" is typically general and that recommendations are not

“cast in stone”. It is fully intended that, as particular projects are implemented, the actual scope of improvements contained in this report will again be validated or refined to meet actual conditions at the time the improvements are implemented and through a continuing public participation process.

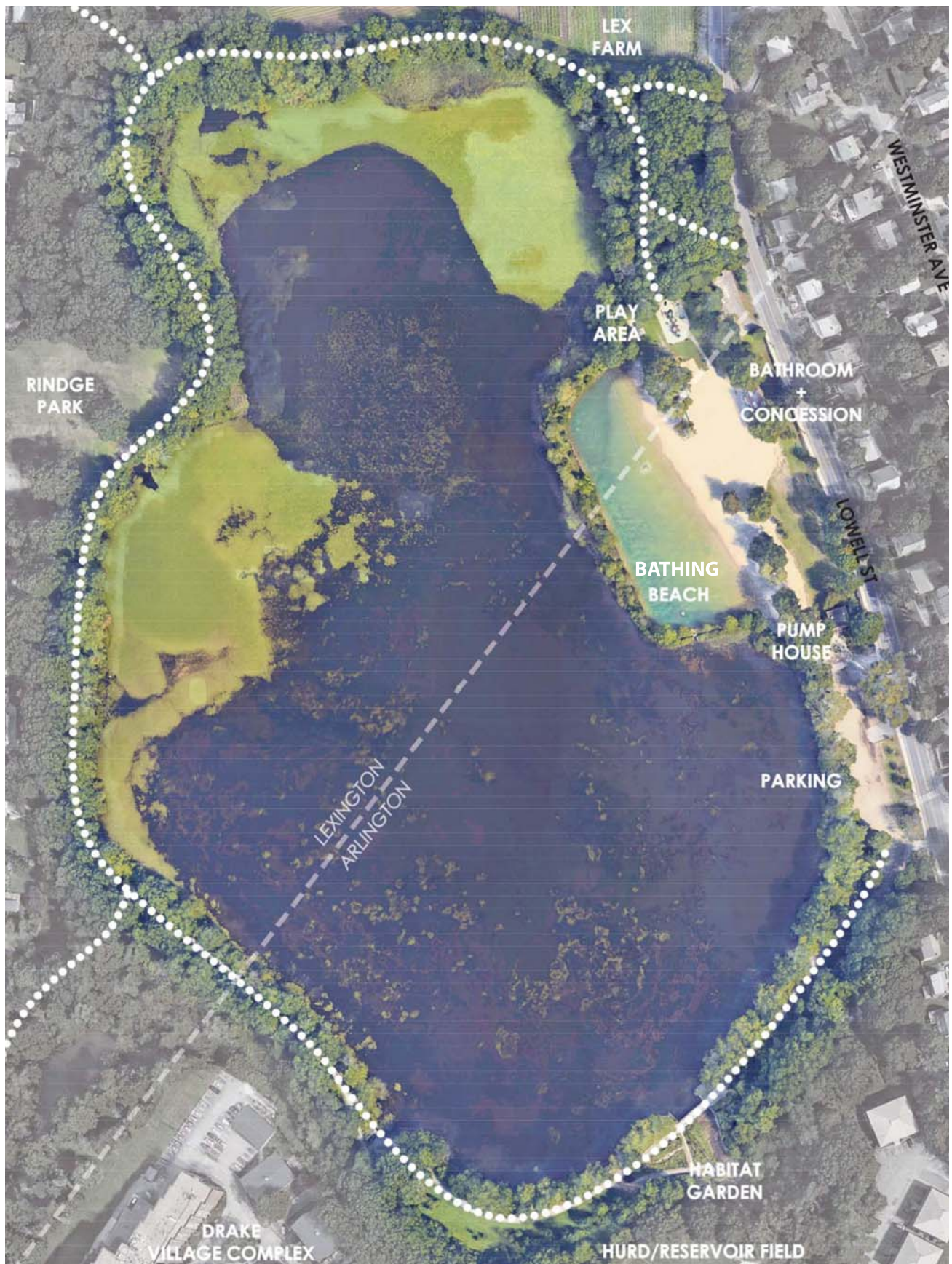
BACKGROUND AND RESERVOIR HISTORY

This master plan focuses on the Arlington Reservoir and its environs, located in the Arlington Heights neighborhood with Lowell Street forming its eastern edge. Although all of The Res and its shoreline are owned by the Town of Arlington, about half of the area is located in Lexington. It is approximately 65 acres in size, bordered on the north by Lexington Community Farm (Lex Farm), formerly called Busa Farm, Arlington’s Hurd/Reservoir Field and the Drake Village Complex to the south, and Lexington’s Rindge Park and residential Rindge Avenue to the west. The Res offers both passive and active recreational opportunities for both informal and formal use. It is used by community members and others year-round for walking, jogging, cross-country running and skiing, bird-watching, fishing, non-motorized boating, skating, dog walking and gardening. During the months of June, July and August, the Town operates a gated, chlorinated and filtered sandy bathing beach for resident and non-resident tag holders. The bathing beach area includes a bathhouse, concession stand, pump house with water filtration systems, picnic tables, benches and playground. Beyond the bathing beach area, there is a packed-dirt parking lot, forested area, a habitat garden, a reinforced dam with two outlets for flood mitigation, and a nearly one-mile trail path that encircles the water. Refer to the aerial photograph to the right for the location of various facilities within The Res property.

The Res is part of the watershed connecting Arlington’s Great Meadows in Lexington to the Mystic Lakes and Mystic River via Mill Brook. The water body was created in 1871 by damming Munroe Brook to impound water for local water supply purposes. Arlington joined the Metropolitan Water District in 1899, which made the reservoir obsolete for supply purposes. The 28-acre reservoir has been left as aquatic habitat and used for recreational purposes since that time. The land is protected open space through chapter 97 of Massachusetts General Law, as is required by grants awarded through the Land and Water Conservation Fund. The Town significantly improved the beach in the early 1980s, adding a water filtration system and an earthen berm to separate the swimming area from the rest of the reservoir. The design plans showing these improvements have been included in the Appendix K.

In 2002-2003, a collaborative effort between the Arlington Public Schools art/science programs, the Arlington Center for the Arts (ACA) and the Arlington community resulted in the exploration of the ecosystem of the Arlington Reservoir. “A Tour of the Arlington Reservoir” guide was produced and documents issues in the area; it has been included in Appendix D. As part of this efforts, The Res was introduced to several classes of elementary school students as a field study opportunity.

In 2006, the Town successfully completed a major award-winning engineering project to rehabilitate the earthen dam; a handout has been include in Appendix H. This project ensured the dam’s continued safe operation, while protecting the natural landscape. In 2010, the Reservoir Committee established a native plant Wildlife Habitat Garden adjacent to the new emergency spillway, which will be discussed in greater detail in the proceeding pages.



Aerial photography showing existing conditions

Public Participation and Community Process

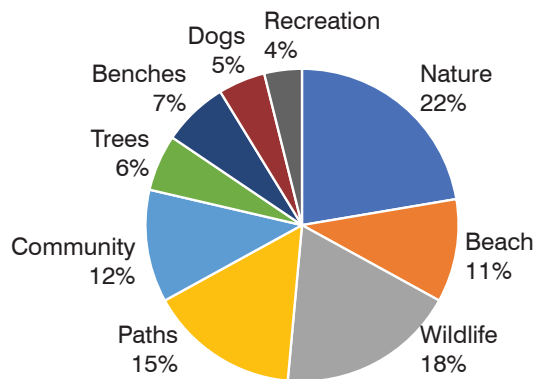
The master planning process included a comprehensive amount of community engagement, with primary meetings identified in the chart located below.

Meeting	Subject	Date
Weekend Information Session	On-site meeting to gather community input	Saturday September 23, 2017
Public Input Meeting #1	Review of schedule and master plan scope; charette and walkabout guide results; review of existing conditions and analysis of the site; discussion of design opportunities and feedback regarding current and desired needs of the overall site; next steps; public comment	Thursday October 26, 2017
Walkabout Guide	Paper-based questionnaire asking for feedback on activities and facilities to be improved, the best and worst aspects of The Res, and what is missing. All input received has been included in Appendix C.	September 23 to November 15, 2017
Public Input Meeting #2	Review of Public Input Meeting #1; review of the project schedule and master plan scope; discussion of environmental and pump equipment assessments; review of what has been heard from the public to date; presentation of preliminary concepts and associated cost estimates; discussion of possible priorities and phasing options; next steps; public comment	Thursday November 30, 2017
Public Input Meeting #3	Presentation of the preferred plan, funding opportunities, and next steps for implementation	April 3, 2018

These meetings were held at various locations including The Res itself, the Town Hall Auditorium, and the Senior Center. The attendees included members of the community, abutters, neighborhood residents from both Arlington and Lexington, neighboring organizations and Town representatives. For the public input meetings, Weston & Sampson presented information via a powerpoint slideshow. A series of presentation boards were also displayed and discussed based on the specific subject of the meeting as outlined above. Walkabout guides were distributed at the Weekend Information Session. Comments were encouraged throughout each presentation and welcomed in between meeting via email, which have been included in Appendix A through C. At each meeting, the feedback was positive and the community concluded the process with clear preferences for a plan that best met both passive and active recreational needs.

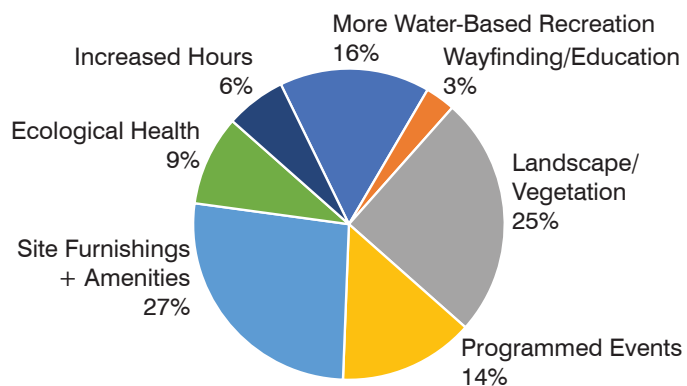


Weekend Information Session at Arlington Reservoir



BEST THINGS ABOUT THE RES

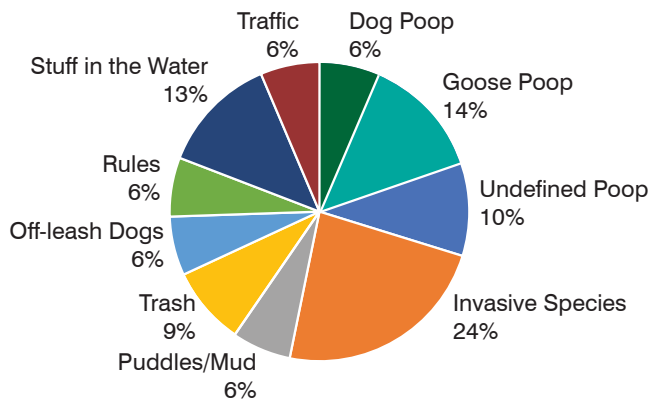
- Swimming!
- Habitat garden, wildlife and trails
- The willow trees
- Shade and grass on the beach
- Nature trail near Lex Farm
- The loop trail
- The shady beach!
- Fall/Winter walks with the dog
- The beach is very affordable



IMPROVEMENTS NEEDED

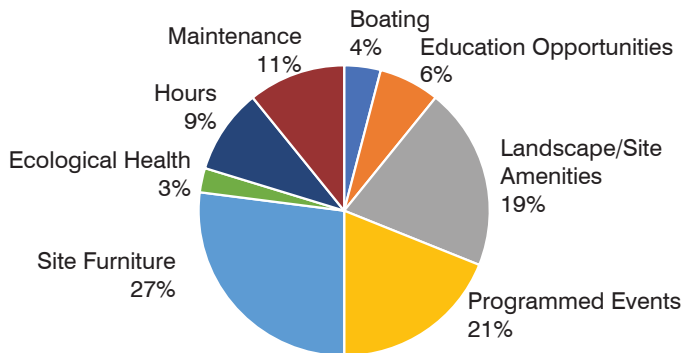
- More tables for lunch
- Bigger swim area
- Better maintenance of trails
- Splash pad!
- Water slide
- More walking/trail options
- More events (concerts, movies, etc.)
- Swimming lessons

Public feedback received through the community outreach process



I WISH THE RES HAD LESS...

- Invasive plants
- Debris floating in the water
- Fencing along Lowell Street
- Geese!
- Sediment in the swimming water
- Erosion
- Goose and Dog poop
- Snow plowing! (cross country ski)
- Scum on bottom of swim area



I WISH THE RES HAD MORE...

- Seating
- Available beach hours in summer
- Information on wildlife
- Viewing opportunities
- Public art
- Year round access
- Trash cans
- Landscaped vegetation

Public feedback received through community outreach process

ARLINGTON RESERVOIR MASTER PLAN
WALKABOUT GUIDE
please answer as you see fit

Activities and facilities that would improve Arlington Reservoir include: MORE COMMUNITY EVENTS AT THE RES TO BENEFIT IT AND BUILD RELATIONSHIPS

The best things about Arlington Reservoir are: COMMUNITY INVOLVEMENT, FAMILY-FRIENDLY, VERY AFFORDABLE, RECENTLY EXPANDED MENU AT THE SNACK SHACK

I wish Arlington Reservoir had more: IF I UNDERSTOOD MY WIFE CORRECTLY, SHE WOULD SAY: SWIMMING LESSONS FOR KIDS (FOR A FEE OF COURSE)

I wish Arlington Reservoir had less: COUNTLESS ROCKS ON THE BEACH

What is missing in Arlington Reservoir? NOT MUCH AT ALL. MAYBE A BODY CHANGING STATION IN BOTH TOILET ROOMS, OR A COMMON SHOWER AREA FOR THE EXIT.

CONTACT INFORMATION (optional):

Please leave this guide at the workstation where you picked up your clipboard. If you think of more to say later, please visit:
<http://www.arlingtonma.gov/departments/recreation/capital-projects>
<http://arlingtonreservoir.org/reservoir-master-plan/>

ARLINGTON RESERVOIR MASTER PLAN
WALKABOUT GUIDE
please answer as you see fit

Activities and facilities that would improve Arlington Reservoir include: healthy food offerings, more tables for lunch, move changing rooms, spray park, 5 yr old says - water slide and water play ground

The best things about Arlington Reservoir are: the state for little kids, neighborhood feel

I wish Arlington Reservoir had more: cleaner bathrooms, changing space / tables for babies, hours in summer - season ends too early

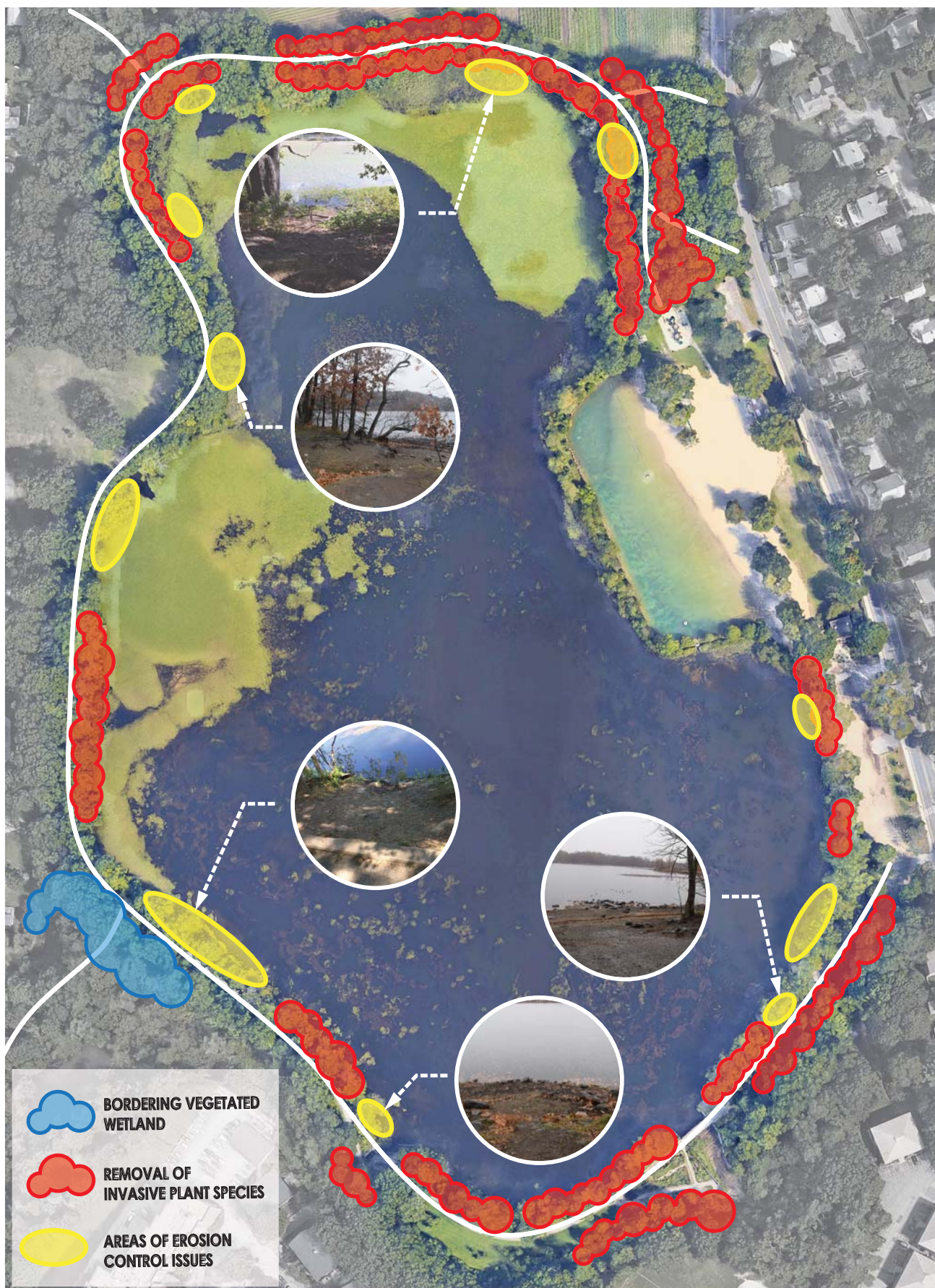
I wish Arlington Reservoir had less: seaweed

What is missing in Arlington Reservoir? a full summer schedule, lunch options

CONTACT INFORMATION (optional):

Please leave this guide at the workstation where you picked up your clipboard. If you think of more to say later, please visit:
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Examples of the public input received via the walkabout guide. All input has been included in Appendix C.



Environmental findings at Arlington Reservoir

EXISTING CONDITIONS

As with many beloved neighborhood parks and town destinations that offer a broad range of recreational opportunities, years of continuous use have caused wear and tear to The Res infrastructure, which make the built assets difficult to maintain and ultimately causes a degraded user experience. The regular use, combined with a lack of capital investment and continued deferred maintenance, has led to the current state of general disrepair.

Beyond improvements at the bathing beach facilities, it should be noted that erosion control issues, invasive plant species and trail conditions have been identified as needing improvement and will be discussed in great detail within the Environmental Assessment section of this Master Plan. The analysis diagram on the preceding page illustrates these particular existing conditions and site characteristics that prevail at the property.

Neighborhood Context

BUS ROUTES

Several bus routes that travel through Arlington and connect to Cambridge and Bedford terminate or begin at the Arlington Heights Busway on Massachusetts Avenue. It is less than a half-mile walk from the busway to The Res across the Minuteman Bikeway and the Hurd/Reservoir Fields.

The Town of Lexington operates a neighborhood bus called the Lexpress and Route 1 that takes passengers to Depot Square and East Lexington via Pleasant Street and Massachusetts Avenue. During peak hours, buses on this route travel down Lillian Road, take a right on Lowell Street, and then turn right onto Park Avenue. Peak hours run during morning and evening rush hours. There are two stops along The Res frontage on Lowell Street: at the intersection of Westmoreland Avenue and at Elder Terrace.

FLOW OF WATER

Munroe Brook enters The Res from Lexington in the northwest and feeds The Res. The water within the reservoir discharges in the south via a dam and gate system at the confluence with Sickles Brook (also known as Cataldo Brook and Fottler Brook) to form Mill Brook, which then flows for approximately 2.7 miles through Arlington until it discharges into the Lower Mystic Lake through a culvert under the Mystic Valley Parkway.

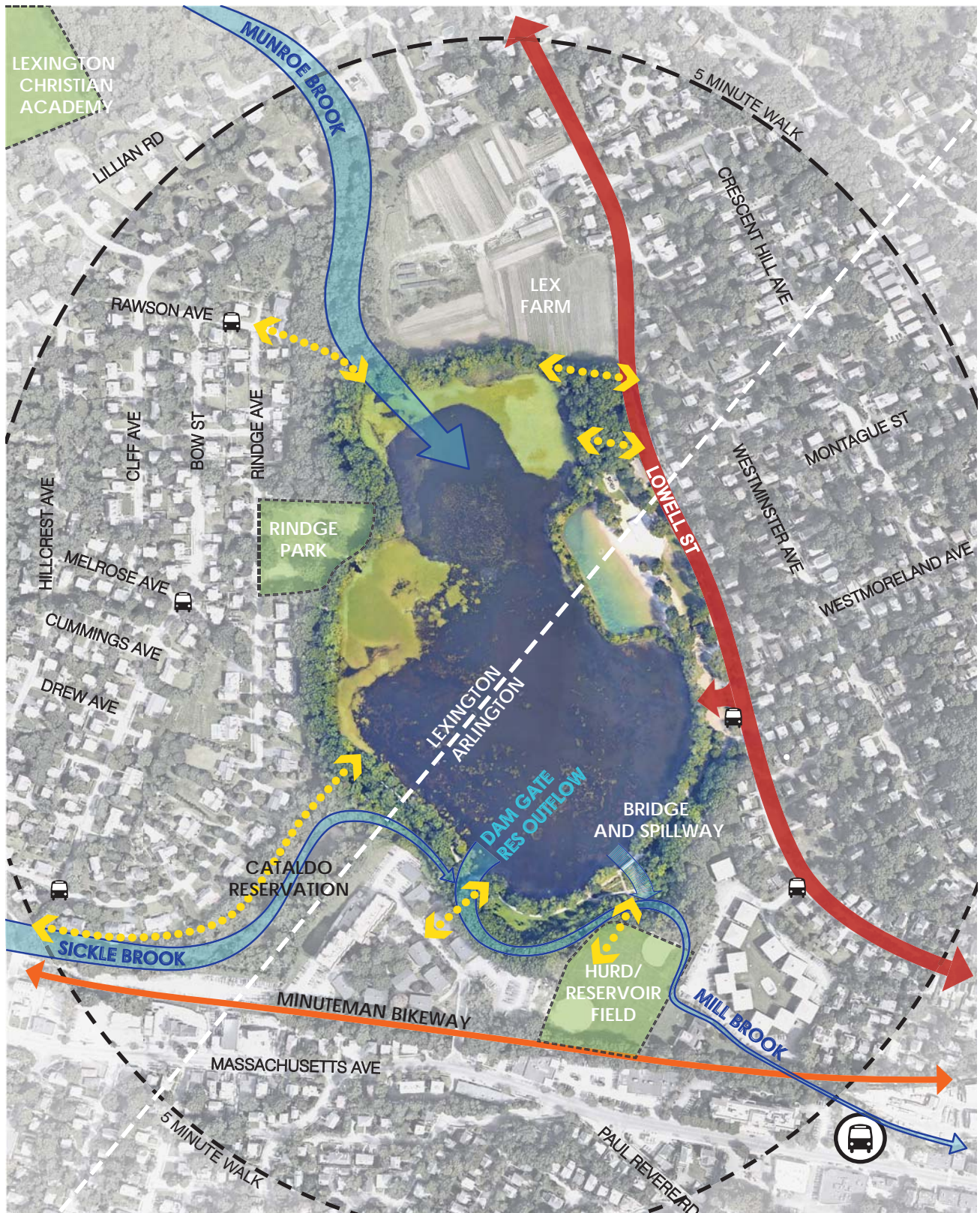


The inlet from Munroe Brook, feeding into The Res

TRAIL CONNECTIONS

Along the perimeter path, there are numerous trail connections, as indicated with the yellow dotted arrows diagram on the following page. They include connections to Hurd/Reservoir Fields, the Drake Village Complex, Bow Street, Minuteman Bikeway, Great Meadows, Rawson Avenue, and Lowell Street toward Whipple Hill. These connections vary in quality and many are not traversable for the

average user. The trail connections to the Drake Village Complex and to Hurd/Reservoir Fields are especially difficult to navigate, as noted on the analysis diagram on page 29. The condition of the perimeter pathways will be discussed in greater detail later within this section.



Context diagram showing bus stops, other open space destinations, trail connections, and flow of water

REGIONAL OPEN SPACE DESTINATIONS

Minuteman Bikeway - Running just south of The Res, the Minuteman Bikeway connects Bedford to Cambridge and passes through four communities: Bedford, Lexington, Arlington and Cambridge. Today, the Minuteman Bikeway is an extremely successful and popular rail-trail that is enjoyed for both healthy recreation and transportation. The Res marks the approximate center point of its ten miles. Built on an inactive railroad right-of-way, the Minuteman Bikeway connects to the Alewife "T" Station in Cambridge and provides a means for bicyclists and pedestrians to travel to and from subway and bus lines with less reliance on automobiles.

Hurd/Reservoir Fields - Hurd/Reservoir Fields share a border with The Res by way of Mill Brook. This park is home to two baseball diamonds and a multi-use soccer field and hosts a number of youth and adult leagues throughout the spring, summer, and fall. The large baseball diamond has a large backstop, players benches for both teams and a small bleacher area. The other diamond has a backstop and benches but no bleachers. The Town leaves movable soccer goals at the park for use all summer.



Hurd/Reservoir Fields



Rindge Park (Image courtesy of Facebook)

Rindge Park - Rindge Park is located in Lexington along The Res's western border. It is an asset of the Town of Lexington and is home to a basketball court, tee ball fields, a playground suited for ages two to five and a large open lawn for passive recreation. There are also a few particularly well-beaten paths along the shoreline for views across The Res.

Vehicular Access and Parking

At present, there are two parking areas at The Res. The primary parking lot is located along Lowell Street at the southeast corner of the property. It has two paved asphalt entrances which open to an informal, packed dirt and gravel parking area. The parking area's lack of striping and fixed surfacing has historically led to very muddy conditions after a rain event, a variety of ad hoc parking situations, and unsafe vehicular and pedestrian circulation. Approximately fifty-five to sixty cars find a way to fit into this lot at peak season in sometimes suspect parking orientations. On particularly hot days, parking for the beach overflows onto Lowell Street, which is not permitted. The more southerly entrance leads to a boat launch along The Res, which will be discussed in greater detail in the following paragraphs.

The second parking area is much smaller and is located along Lowell Street next to the playground. This parking area is fully paved and fits just a few cars. This lot is typically used for staff parking, drop off for group parties, and deliveries.



Northernmost entrance to main parking lot



Parking lot at peak season

Boat Launch

The boat launch is currently located just south of the parking lot and off the driveway that becomes the perimeter trail, beyond the bollards and a swing gate controlled by the Department of Public Works. Given that this gate is typically locked, the general public can not drive to and make use of the launch. This driveway is also an extremely sharp one-way loop back to the parking lot and would be difficult to maneuver with a boat hitch. During the community meeting process, many residents requested that the boat launch be publicly accessible and more centrally located to allow for recreational watercraft drop-off. The launch itself is made of a loose gravel material littered with larger rocks. It serves as the launching point for recreational watercrafts as well as the equipment used to perform annual management of invasive water chestnuts.



Existing boat launch



The boat launch is located just off the edge of this photograph on the left. The trailhead shown here marks the start of the perimeter trail and one of the parking lot entrances can be seen in the distance on the right side of this image.

Lowell Street Edge

The Arlington Reservoir is bound by Lowell Street on the east. This street edge is marked by a patchwork of fencing, most of which is in disrepair, with periodic openings for pedestrian or vehicular access. A sidewalk runs along the entire edge with curb cuts for driveway access into the parking lot.

The two openings in the fence at the parking lot are gated such that the parking lot can be secured if needed. The opposite side of Lowell Street does not presently have a sidewalk. Crosswalks are currently located at the intersection of Lowell Street and Westmoreland and West Court Terrace. Overhead wires line The Res side of the street. Any tree canopy cover along the street comes from within The Res or within the residential properties across the street. There are no dedicated street trees within the Lowell Street sidewalk, which does not create the most hospitable streetscape experience for pedestrians passing through.

Bathing Beach

A popular summer spot, the bathing beach was first developed in 1935 and renovated to include the berm and water filtration equipment in 1982. The beach area is enclosed by a perimeter chain link fence and includes a bathhouse and concession building, a pump house, a playground, benches, and picnic tables. It is staffed with certified lifeguards during the bathing beach season from mid-June through late August. The beach area has three points of entry: at the pump house, at the small staff parking lot gate along Lowell Street, and at the start of the perimeter trail at the northern end. During the beach season, these gates are locked and reservoir tags are checked at the pump house entry.



Bathing beach in August 2017

The beach consists of roughly 56,000 square feet of sand. Much of it migrates into the swimming area over the year and, as a result, requires constant monitoring and annual replenishment to maintain the beach in its current size and state. The bathing beach is flanked by scrubby vegetation on its north and south sides, lawn and concession to the east and the swimming area to the west. Three lifeguard stands dot the beach and two lines of benches run along its eastern edge to total nine benches at the southern end and ten benches at the northern end. As a typical condition, each bench post has its own foundation such that each bench has three posts and footings, as opposed to the bench sitting within a concrete slab. In most cases, the earth has eroded around these bench post foundations such that their seating height is no longer comfortable for the average user. At one time, a concrete pathway and handrail system located at the southern end of the beach provided handicap access into the swimming area. The pathway is surrounded by sand, making it inaccessible and non-compliant.



Analysis diagram of the beach and parking area, showing trail conditions, incomplete or non-compliant walking path connections, seating and viewing opportunities, deteriorated perimeter fencing and disjointed programmatic elements



Typical bench condition



Non-ADA compliant concrete pathway and handrail system in foreground; the berm in background.

The table below shows beach usage over the past five years:

	FY 2013	FY 2014	FY 2015	FY 2016	FY 2017
Reservoir Tags					
Adult Resident	423	426	363	279	215
Child Resident	376	364	374	339	198
Senior Citizen	60	59	74	68	53
Non-Resident	6	3	0	0	0
Resident Family	511	470	459	325	272
Non-Resident Family	30	0	0	0	0
Resident Family + 1	74	109	11	79	66
Non-Res. Family +1	0	0	0	0	0
Total Season Passes	1,480	1,431	1,281	1,090	804
Total Daily/Individual Passes	5,375	6,172	9,565	8,806	11,782



Exposed roots within sandy beach

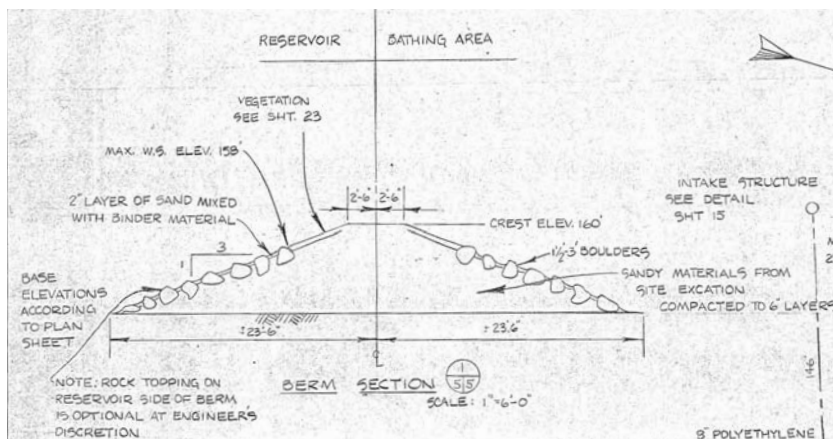


Mature canopy that shades the beach edge

One of the bathing beach's greatest assets is the row of mature sycamore, maple and willow trees that lines its eastern edge. The trees range in size from 18-inch to 42-inch caliper and provide a

respite from the bright sun during the hot days of summer. Constant sand and soil erosion around these trees, however, has resulted in exposure of the root systems, thus compromising their future viability. Additionally, the roots can pose a tripping hazard.

The swimming area is impounded on three sides by an earthen berm that rises approximately three feet out of the water and tapers back to the water at a 3:1 slope. It is armored on both sides by stone riprap. This berm is interrupted by a sluice gate and concrete spillway on its southern end, which provides the only water flow connection between the swimming area and the rest of the reservoir. An informal walking trail runs along the top of the berm. The trail is overgrown with vegetation, making it barely three feet wide. The surface is very uneven due to tree roots, animal burrows and erosion. The filtered swimming water is fed by a series of inlets spaced evenly north to south along the deepest part of the swimming area. Water is also delivered through a fountain found in the north end of the swimming area.



Berm construction from 1982 Record Plans



Sluice gate and concrete spillway; pathway around the berm beyond

Pump House

The water filtration building is a one-story, 800-square-foot seasonal structure constructed in 1982. Existing drawings by Environmental Design & Planning dated April 1982 are available for review in Appendix K. Overall, the building is in fair condition, but in need of general repairs, upgrades and maintenance. Specific observations are as follows:



North and west elevation of the pump house

BUILDING ENVELOPE

Roof - The roof assembly consists of a built-up tar-and-gravel membrane over a metal deck. It is not known if any thermal insulation or vapor retarder is present in the roof system. There is a single interior drain at the southwest corner of the roof. The condition of the roof is fair to poor, with leakage noted at the interior.



Pump house roof condition



Interior flood condition with intake piping to swimming area

Walls - The 12-inch concrete masonry exterior walls appear to consist of an 8-inch interior CMU (concrete masonry unit) wythe with a 4-inch exterior split-face CMU block veneer. It is assumed that there is no insulation or drainage cavity in this wall assembly. The exterior masonry shows signs of deterioration from moisture intrusion and vegetation growth.

Floor - The interior floor is cast-in-place concrete with a painted finish. Its condition appears to be good, with no observed cracking or displacement. It is assumed that there is no thermal insulation or vapor barrier in the floor construction, and that thermal bridging exists around the floor slab perimeter. This is not problematic for a warm-season-only building.

Openings - There are no windows or skylights present. There is one double exterior door. The steel doors and frame are showing some corrosion at their lower edges. Hardware operation was acceptable. The door frame is not thermally broken. The presence or condition of weatherstripping was not verified. There are two aluminum louvers at the North wall, which appear to be in good condition. No assessment was made on any dampers associated with these louvers.

INTERIOR CONSTRUCTION AND FINISHES

There is a small enclosed storage/workroom in the southeast corner with CMU walls, and partial-height cast-in-place concrete containment walls for chemical tanks along the east wall. These assemblies are in good condition, although cleaning, surface preparation and re-painting would prolong their useful life. The door and frame to the storage/workroom is corroded at its bottom edges.

POTENTIAL PRESENCE OF HAZARDOUS MATERIALS

Original roofing materials, including mastics, sealants and membranes may contain asbestos,

although the building is relatively recent and thus, the presence of hazardous materials is considered unlikely. PCB-containing sealants, electrical components, lead-based paint etc., may be present, although this is unlikely due to the age of the building.

BUILDING CODE COMPLIANCE

Architectural renovations to the structure will be guided by the International Existing Building Code 2015 as amended by the Massachusetts Building Code 9th Edition, by the current edition of the Massachusetts Architectural Access Board regulations, and by OSHA standards, as applicable.

OSHA COMPLIANCE

As an industrial-process facility, the building is generally not governed by building code requirements for accessibility, egress, protection of openings, etc. OSHA standards typically prevail in such cases. No apparent deficiencies were noted at the time of Weston & Sampson's site visit; however, this observation does not include any evaluation of required clearance or protections around mechanical or electrical equipment. It was assumed that this facility is not classified as a hazardous use in any respect.

STRUCTURAL



Flat roof interior with steel bar joists



Walls showing interior CMU wythe

The flat roof consists of metal roof deck supported by 8-inch deep steel bar joists. The steel bar joists are supported on a 12-inch wide flange beam at the center of the structure and 12-inch concrete masonry at the perimeter. The structure is constructed on shallow concrete foundations. Overall the structure is in fair condition. The existing metal roof deck has areas of corrosion. There is an unframed penetration through the roof for an exhaust fan. The steel bar joists and steel beam also have areas of corrosion. The concrete masonry walls show signs of deterioration from moisture intrusion vegetation growth. There are no signs of settlement of the structure.

Bathing Beach Filter System and Water Quality

The current filter system utilizes a high-rate pressure sand filter, pumps, strainers, and liquid sodium hypochlorite disinfection pumps. The current pump system has been sized for 1800 GPM, but the system may be operating between only 1200-1600 GPM. There was a conversion performed over twenty-five years ago that converted the system from a vacuum suction filter to a pressure sand filter system. With this, there is a flow control structure found outside of the filter building, which retrieves water from the swimming area and suctions from the basin as well as fills the system with reservoir water.

There are many challenges with the current filter system, as noted below:

- The filter sand has not been changed in over ten years. The vessel is rusted. Operation has not been able to properly backwash the vessel and it is unknown how much sand is still in the filter.
- The pump is currently a vertically-mounted pump, however, it is a flood suction pump that is above the static water level, which makes it challenging to prime.
- The chemical controller no longer works and it doesn't appear to have worked for years.
- Instrumentation, such as flow meters and pressure gauges, do not function properly.
- The chemical injection system is not interlocked with the pump.
- The Town uses domestic water to supplement filling the swimming area when the water is too low.
- Site valves either do not open and operate or are difficult to operate.



Chlorine Disinfectant Holding Tanks



Vertically-mounted Pump and Strainer

Currently, the water is circulated by the above-mentioned filtration system and is delivered back to the bathing beach through a series of inlets found in its deeper side. Water is also delivered through a fountain within the swimming area. It is a challenge to keep the water clear and not cloudy. For instance, animals such as ducks and geese land, nest, and contaminate the water. Currently, the water is not skimmed because it requires manual labor. Skimming would remove the dirtiest part of the water.

The water that is delivered through inlets comes into the swimming area at a high velocity, which can impact patrons. These inlets are embedded in rocks, found along the perimeter of the beach at its deepest section, and can be an abrasion hazard for swimmers. The earthen berm edges do not offer a point of refuge for a tired swimmer to hold onto the wall or exit the bathing beach along these edges and may be difficult for lifeguarding staff to navigate. Better identification, such as rope and floats, would help swimmers identify when they are entering an area that is deeper than five feet.

Bathhouse & Concession Building

This park building is a one-story 800-square foot seasonal structure renovated in 1982. The original construction date is unknown. There are concrete masonry screen walls at the restroom doors. Overall, the building is in fair condition, but it is in need of general repairs, upgrades, accessibility improvements and maintenance. Specific observations are included on the following pages.



West elevation of the Bathhouse and Concession building

BUILDING ENVELOPE

Roof - The roof assembly consists of asphalt shingles over a wood deck, with flush-mounted translucent skylighting panels at two locations. No thermal insulation or vapor retarder appears to be present. The roof system is past its useful life and is in need of complete replacement. Unit-type skylights in place of the skylighting panels is recommended. No gutters or downspouts are present, but are recommended as part of any roof replacement project. The rake and eave trim assemblies are painted wood and in fair to poor condition. There is evidence of squirrel and insect damage at several locations.

Walls - The exterior walls consist of a single 8-inch wythe (thickness) of CMU, split-faced at the exterior and smooth surface with paint finish at the interior. There is no apparent insulation or drainage cavity in this wall assembly. The exterior masonry shows minor signs of deterioration from moisture intrusion and age.



Floor and walls inside the concession area



Typical door and frame condition at a restroom

Floor - The interior floor is cast-in-place concrete with a painted finish. Its condition appears to be good, with no observed cracking or displacement. It is assumed that there is no thermal insulation or vapor barrier in the floor construction, and that thermal bridging exists around the floor slab perimeter. This is not problematic for a warm-season-only building.

Openings - There are translucent skylighting panels in two locations at the west slope of the roof, providing daylight to the Men's and Women's rooms. These panels are installed as part of the shingle roof system, and are not separate skylights as such. There are significant leaks at the lower edges of these panels. There is a single service window at the west wall, which is protected by a roll-up metal shutter. The condition and operation of the shutter was not verified, but it appears to be in serviceable condition. The service window is not accessible, as discussed below.

For door openings, there are three single steel exterior doors. The doors and frames are showing some corrosion at their lower edges. Hardware operation was not verified. The doors and frames are not thermally broken. The presence or condition of weatherstripping was not verified.



West elevation of Concession and skylights



Wood fascia board in poor condition

In terms of louvers, there are rectangular wooden gable vents at each end of the building, which were closed off with exterior plywood panels for the winter. These vents provide direct ventilation of the Men's and Women's rooms, in conjunction with roof-mounted exhaust fans. There are two aluminum louvers at the east wall, which appear to be in good condition. There is no mechanical equipment or dampers associated with these louvers, which only provide passive intake air into the Men's and Women's rooms.

Other Exterior Elements - There are CMU screen walls at each of the Men's and Women's entrances. These appear to be newer additions to the building as the style of CMU does not match and they are not integral to the main building walls. The screen walls are constructed of a double wythe (thickness) of 4-inch thick block, and it could not be verified if any vertical or horizontal reinforcement is present. Unreinforced, un-braced masonry poses a hazard, as noted in the structural review below. There is also a minor degree of deterioration of mortar at the base of these walls.

INTERIOR CONSTRUCTION AND FINISHES

The Bathhouse and Concession Building is subdivided into Men's and Women's toilet/changing rooms and a small food service area. These three areas are not internally connected. Interior walls and partitions are painted CMU. There are furred-out CMU chases behind sinks, urinals and toilets,

which appear to be constructed of 4-inch block. The food service area has a dropped GWB (Gypsum Wall Board) ceiling, while the remaining areas are open to the underside of the roof, which is painted. The food service area is accessed through a small vestibule, which contains some electrical and telephone equipment and small water lines. There are no cooking facilities.

MECHANICAL, ELECTRICAL AND PLUMBING

Domestic Water, Waste Piping - The condition of under-slab and other concealed supply, waste and vent piping was not assessed as part of this investigation. No drainage issues were reported, but water was present at the floor of the Men's room and may have originated at a floor drain. The outdoor shower drains were also flooded. While it requires further investigation, this is assumed to be an off-season issue. Water service in the building was shut off at the time of our visit, and shower heads and flush valves removed. It is understood that adequate domestic water pressure and flow is available at the building for the current fixture needs. We note that water demand is likely to be reduced in the future with the installation of new, code-compliant faucets, flush valves and showers. No domestic water heating equipment, tempering valves or circulators were noted. No gas service to the building was noted.

Plumbing Fixtures - All existing sinks and sanitary fixtures otherwise appeared to be functional and in satisfactory condition, although most are old and recommended for replacement. The condition of fixture carrier chairs concealed in plumbing chases could not be determined, but these should be assessed and replaced as needed. Hinged access panels in the chase walls are corroded.



Women's room partitions and fixtures



Men's room partitions and fixtures

Toilet Partitions & Accessories - Toilet partitions and accessories, including grab bars, mirrors, shelves, hand dryers, soap and toilet paper dispensers, etc., are in fair to good condition, but should be considered for replacement as part of an overall upgrade to the toilet rooms.

Heating & Ventilating - There is a grille at the ceiling of the food service area, but it is not known if this is connected to any mechanical supply or exhaust air system. It appears to terminate in the Men's room. The Men's and Women's rooms each have a roof-mounted exhaust fan, with passive intake louvers at the lower East walls. The type and location of ventilation controls was not noted. There is no heating or cooling equipment.

Electrical System - Electric service enters the building underground, with meter and panelboards inside the food service vestibule. The type, condition, and capacity of the building's electrical systems

were not evaluated as part of this assessment. No known issues were reported. Interior lighting is by fluorescent tubes in moisture-resistant enclosures. Light levels in the Men's and Women's rooms were poor. Exterior lighting fixtures are outdated, but have been fitted with replacement LED bulbs.



Electrical system within the bathhouse & concession



Passive intake louvers within the bathrooms

POTENTIAL PRESENCE OF HAZARDOUS MATERIALS

Original roofing materials, including mastics, sealants and membranes may contain asbestos. PCB-containing sealants, electrical components, etc., may be present. Lead-based paint may be present at interior surfaces.

BUILDING CODE COMPLIANCE

Architectural renovations to the structure will be guided by the International Existing Building Code 2015 as amended by the Massachusetts Building Code 9th Edition, and by the current edition of the Massachusetts Architectural Access Board regulations. No apparent Code violations were noted at the time of our visit, with the exception of structural items noted below and accessibility items described below.

ACCESSIBILITY

The Bathhouse Building is surrounded by a generally-level concrete pad which offers an accessible route to the building doorways and service window. The asphalt walkway leading to this concrete pad from the north and the walkway connection to accessible parking are not compliant. Access to the building from the south and from the bathing beach to the west is across sand or soft ground.

The Men's and Women's toilet rooms are generally accessible and ADA/MAAB-compliant doorways, toilets, partitions, urinals and lavatories are present. The operation of door hardware, including operating force, was not verified. Small privacy cubicles are present in the Women's room. The presence of an ADA/MAAB-accessible cubicle was not verified. Each toilet room has an outdoor

shower adjacent to the entry door. The receptor pads for these showers are recessed and not wheelchair accessible. At the time of our visit, the shower heads and controls had been removed for the winter and could not be evaluated for accessibility, however residents have reported that the exterior shower valves are currently operated by chains that are frequently broken or missing, making the showers difficult to use for younger children. The west service window height (approximately 40-inches above the ground surface) does not meet ADA/MAAB accessibility requirements.

STRUCTURAL

The gable roof structure consists of plywood sheathing supported by 2x6 wood rafters spaced at 20 inches on center. There were 2x6 cross ties every three to four joists located approximately one foot above the top of wall. The rafters are supported by 12-inch concrete masonry walls. The gable end walls are constructed with 8-inch concrete masonry. The structure is assumed to be constructed on shallow foundations, which is not shown on the 1982 drawings. There are concrete masonry screen walls at the restroom doors.

Overall the structure is in fair condition. There is noticeable deterioration on the interior of the roof sheathing, and based on the condition of the roofing, there will likely be more deterioration found on the exterior side of the sheathing. The bases of several roof rafters are significantly deteriorated, along with areas of the wood top plate on the top of the masonry wall. There is some cracking in the masonry walls, but no signs of significant settlement.

Children's Play Area



Large play structure

A small play area and individual play pieces are located within the limits of the bathing beach, which make them unavailable to the general public and neighborhood during beach season. The large play structure shown above serves children from ages 5 to 12 years old and offers multiple slides, a wobbly bridge, climbers, a zipline, and space for imaginative play. There is also a seesaw, a tunnel and benches included within this play zone. Although an accessible route is provided to this large play structure, the surfacing material is generally sand, which is not ADA-compliant. A 2-to-5 year play structure with a slide, a free-standing set of overhead bars and a swing set all sit within separate zones of sand and do not meet Certified Playground Safety Inspector (CPSI) standards. All of these structures are at least fifteen years old and have reached their maximum life expectancy.



2-5 play structure on sand



Swing set on sand



Overhead bars on sand

Reservoir Perimeter

A perimeter path of just under one mile circles the reservoir and is frequented by neighbors, dog walkers, joggers, birders and others looking for fresh air and exercise. The beginning of the loop path is marked by a deteriorated trailhead kiosk and trail map, located just south of the parking lot, which is discussed later in this section. In this area, the 12-foot wide trail is lined with a concrete curb along its reservoir side and consists of stone dust surfacing. The path's generous width and the concrete curb treatment continue until the trail connection at Drake Village Complex. Here vegetation has been cut back off of the path and the trail condition is fairly uniform with few areas requiring regrading. The trail then narrows and continues as a beaten path for the duration of the loop. The path condition is much more variable as it passes next to Rindge Park and moves north. It becomes a beaten path and varies in width as it passes by the outlet and Lex Farm. In this area in particular, vegetation encroaches on the path's width in various locations and tree roots protrude within the path, making the trail non-compliant by accessibility standards. The trail ends at a deteriorated fence and gate leading into the bathing beach at the playground.



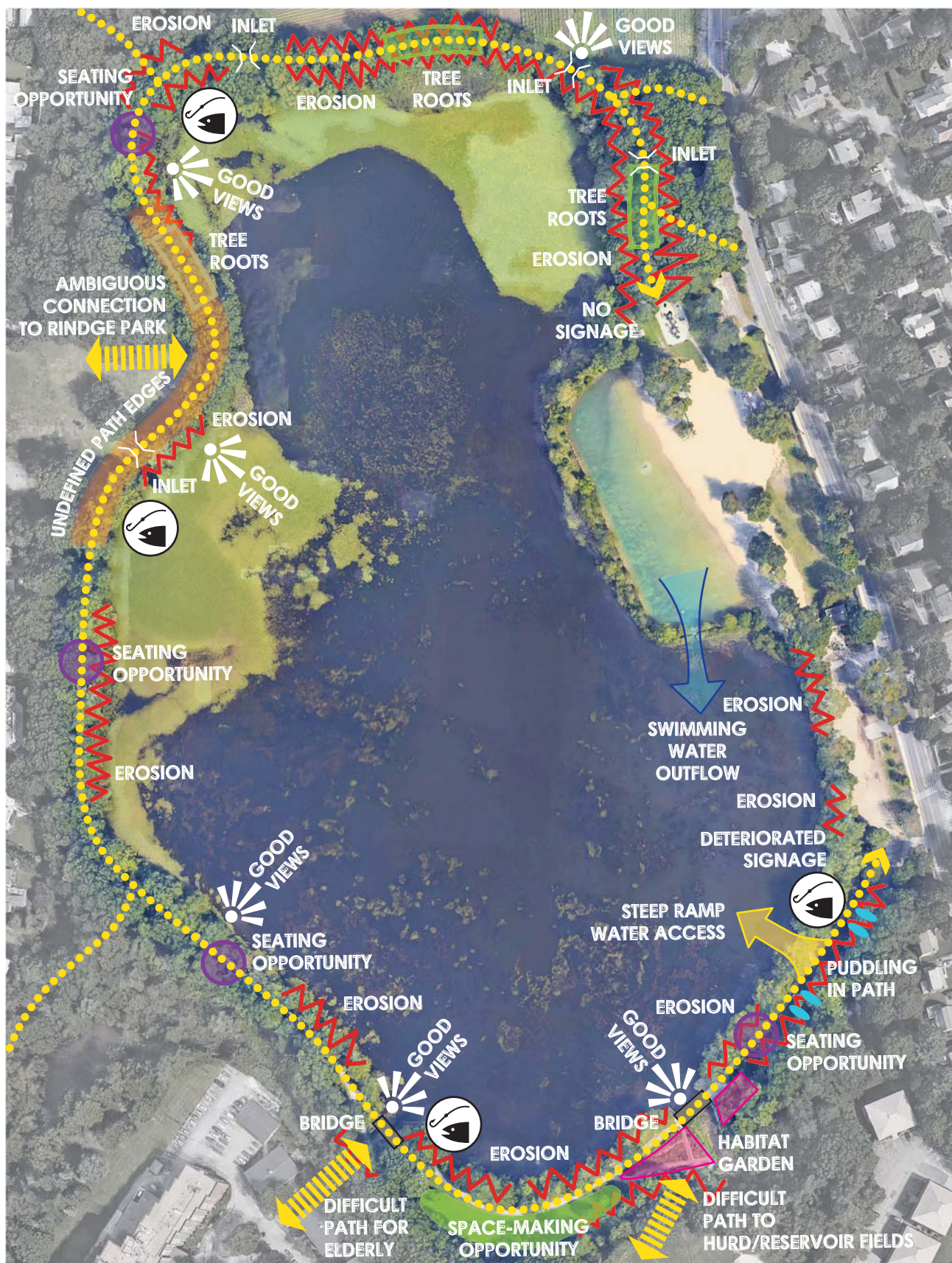
Trail condition next to Busa Farm



Ambiguous trail condition next to Rindge Park

PEDESTRIAN EXPERIENCE

The walking experience along the trail is quite varied and tough to navigate in many areas; the trail widens and then narrows, opens up to big sky at some points and at others, the canopy is thick and completely covers overhead. The perimeter path incorporates two bridges that cross over breaks in the embankment: at the new spillways between The Res and Mill Brook to the south and at the old spillway near Drake Village. Additionally, there is an earthen bridge at the inlet from Munroe Brook in the northern part of The Res, which appears to supply most of the water to the reservoir.



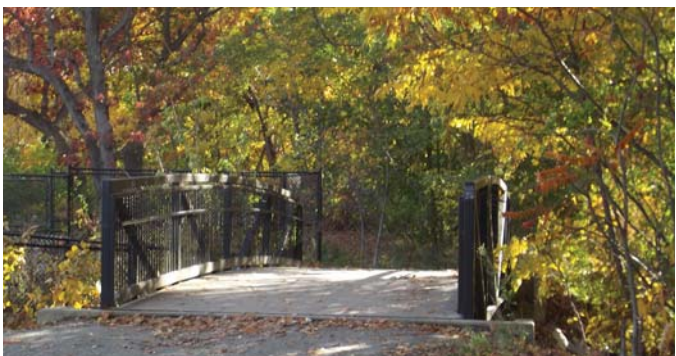
WILDLIFE HABITAT GARDEN

Along the trail is a Wildlife Habitat Garden between the Res trail and the back entry to Hurd/Reservoir Fields. In 1999, the State identified the existing earthen berm enclosing The Res as a potentially high-hazard structure. Instead of the typical engineering solution to remove all the trees along the berm and armor the bank with stone rip-rap, a Reservoir Committee was formed under the Arlington Vision 2020 Committee to pursue alternatives. While a new emergency spillway was still required, a majority of the trees were saved and protected through an innovative engineering strategy. Many more trees were planted and what had been a dump area west of the new spillway was regraded and replanted as part of this construction project, which was completed in 2006. This new space gave way to the development of a native shrub and wildflower garden that attracts local wildlife. The dedicated members of the Reservoir Committee worked with the Arlington Land Trust, the Conservation Commission and the Department of Public Works in the development of this garden, which was constructed in 2011. Preparations for the garden were carried out by Arlington Department of Public Works. The garden was planted and is maintained by the Reservoir Committee.

Although the intent was to make the Habitat Garden accessible, the effort has not yet succeeded. As part of the improvements to The Res, there should be considerations for regrading a pathway such that it meets ADA compliance. In particular, the pathway through the garden from the bridge to the entrance to Hurd/Reservoir Fields is quite steep and highly eroded. This part of the perimeter trail must be regraded and resurfaced with a material that will not continue to erode. An alternate route of steps and pathway should also be considered to ease the grade change.



Trail condition near the Drake Village Complex



One of two bridges along perimeter path



Spillway below bridge shown on left

VEGETATION

Tree species are fairly typical of New England urban forests and include trees such as oak, hickory, maple, beech, and white pine. The upcoming Environmental Assessment section will delve into detail on the understory layer, wildlife, and invasive species found along the shoreline and within the reservoir itself.

SIGNAGE AND WAYFINDING

Many different kinds of signs displaying a range of information can be found along The Res's perimeter trail. There is a lack of consistency in look amongst these signs, which contributes greatly to the sense from residents that there is visual pollution detracting from the tranquillity offered at The Res. The three signs pictured below mark the beginning of the trail at its southern end. The two wooden kiosks have reached beyond their useful lives, especially the one to the right of the granite pillar, which is missing a wooden plank in its center. The kiosk displaying trail maps and community information is useful, but the community would be better served by an all-weather system that provides protection throughout the entire year. The granite pillar is in good condition and denotes overall trail mileage in miles and meters; however, it feels redundant with the two other kiosks in very close proximity.



Community board/trail map kiosk

Granite mileage marker and deteriorated wooden kiosk

In addition to the multiple trailhead markers at the southern end of the parking lot, the trail itself is dotted with a variety of both educational signage and 'ACROSS Lexington' signage, which is denoted with the characteristic colonial hat of Lexington. The Res's perimeter trail falls within ACROSS Lexington's network of marked trails and paths for walkers, runners and trail bikers. While Arlington's Conservation Commission approved the installation of these signs, they are visually intrusive and do not offer proper wayfinding through the property. Directional signage does not currently relate to nearby open space and recreational resources, which would be of great value to all visitors of The Res.

Educational signage found around the perimeter trail appears to be installed by community members, school groups, or college students completing course work or conducting experiments. For example, there are three signs that ask visitors to upload digital photos of a particular area of The Res as part of an ongoing phenology and environmental monitoring project. Another example identifies a colony of Jack-in-the-Pulpit and describes the invasive species that harm its health. Both examples have been constructed with a simple wooden stake to which a paper sign covered with plastic is affixed. It is unclear if these projects are ongoing or if these signs remain after the project has been completed.



Examples of educational signage

ACROSS Lexington signage



Bathing beach rules and regulation signage

Wildlife habitat garden signage

Signage hung from the perimeter fence surrounding the bathing beach displays rules and regulations that pertain to use of the beach. This signage has been vandalized and could be located more prominently as part of the improvements to the beach. Finally, a large upright sign at the Wildlife Habitat Garden describes information about the garden, including the plants growing there and why they were chosen. As is the case with all of the signage within the entire property, this sign has its own aesthetic and is distinctly different from the other large kiosk signs located at the trailhead described above.

Surficial Drainage and Other Existing Utilities

It should be noted that, while no drainage structures currently exist within the Arlington side of The Res property, stormwater runoff flows off of surfaces surrounding the reservoir into the water body itself. Additionally, there is an abandoned drinking fountain located behind the Bathhouse and Concession Building. A sanitary sewer and associated manholes are located along the west side of The Res. Stormwater outfalls into the reservoir and their relationship to the reservoir's water quality will be studied during the first phase of improvements to The Res.

Overall Aesthetics and Landscape Qualities

Although The Res has great foundational features, including magnificent shade trees within the bathing beach and canopy cover around The Res perimeter, wildlife diversity, a widened trail and bridge infrastructure along part of the perimeter path, and a large and diverse active user group, the overall aesthetic qualities of the property are generally poor and adversely impacted as follows:

- There is a general lack of site identity, particularly at primary pedestrian entrances to the property. For the 65 acre site, the property is identified as Arlington Reservoir only at the deteriorated trailhead kiosk and on the Bathhouse and Concession Building.
- The formal points of entry are inadequate relative to the size of the property and do not provide sufficient meeting/gathering areas. Current points of access to the pathways, beach, and parking areas are poorly marked and unwelcoming.
- The street edge along Lowell Street is deteriorated and does not indicate an open space asset.
- Some vegetated areas are overgrown and collect debris and trash. These conditions are particularly seen along the berm containing the bathing beach. Existing vegetation impedes views of The Res from the bathing beach, parking lot, and Lowell Street.
- Within the interior of the property, visual qualities suffer from aging or unmaintained facilities. The Pump House and Bathhouse and Concession building are unsightly and deteriorated.
- The pump and filter equipment serving the bathing beach is in dire need of upgrade or complete removal and replacement in order to improve water quality and reintegrate Reservoir water back into the system rather than using domestic water.
- The main parking lot is often dotted with mud puddles.
- The condition of the fencing along Lowell Street parking area and surrounding the beach is deteriorated and in need of repair.
- The play equipment is beyond its useful life and offers little play value. The sand surfacing below the play equipment is dangerous and not ADA-compliant.
- Sand migration within the bathing beach requires constant upkeep. Its movement has resulted in exposure of tree roots, which compromises the long-term health of the large shade trees at the beach.
- Programming at the beach, access to the Wildlife Habitat Garden, and much of the perimeter trail are inaccessible due to structural accessibility barriers, which include slopes that exceed 5%, lack of handrails, tree roots emerging within trails, non-compliant surfacing materials, and lack of ADA-compliant curb cuts at parking areas.
- The perimeter trail condition is wildly variable and lacks consistent accessibility. Trail improvements should address tree roots, ensure positive drainage away from the paths and establish a typical and consistent width along the entire trail.
- The Res shoreline is dotted with areas of erosion and infestations of invasive species. This will be discussed in greater detail within the Environmental Assessment section.
- Trail connections to neighboring properties or open space resources are either extremely difficult to navigate or are ambiguous. Clear wayfinding signage and path improvements will be essential to improving these connections.
- There are minimal site furnishings along the perimeter path that offer a place to sit and enjoy The Res, especially at viewing and fishing overlooks. The seating provided at the bathing beach is generally in disrepair or the sand has pulled away from the foundations such that it is unreachable for the average person.
- There is a lack of information available to the casual visitor about The Res's long and rich history. Educational signage would help to build The Res's identity.

ENVIRONMENTAL ASSESSMENT

Introduction

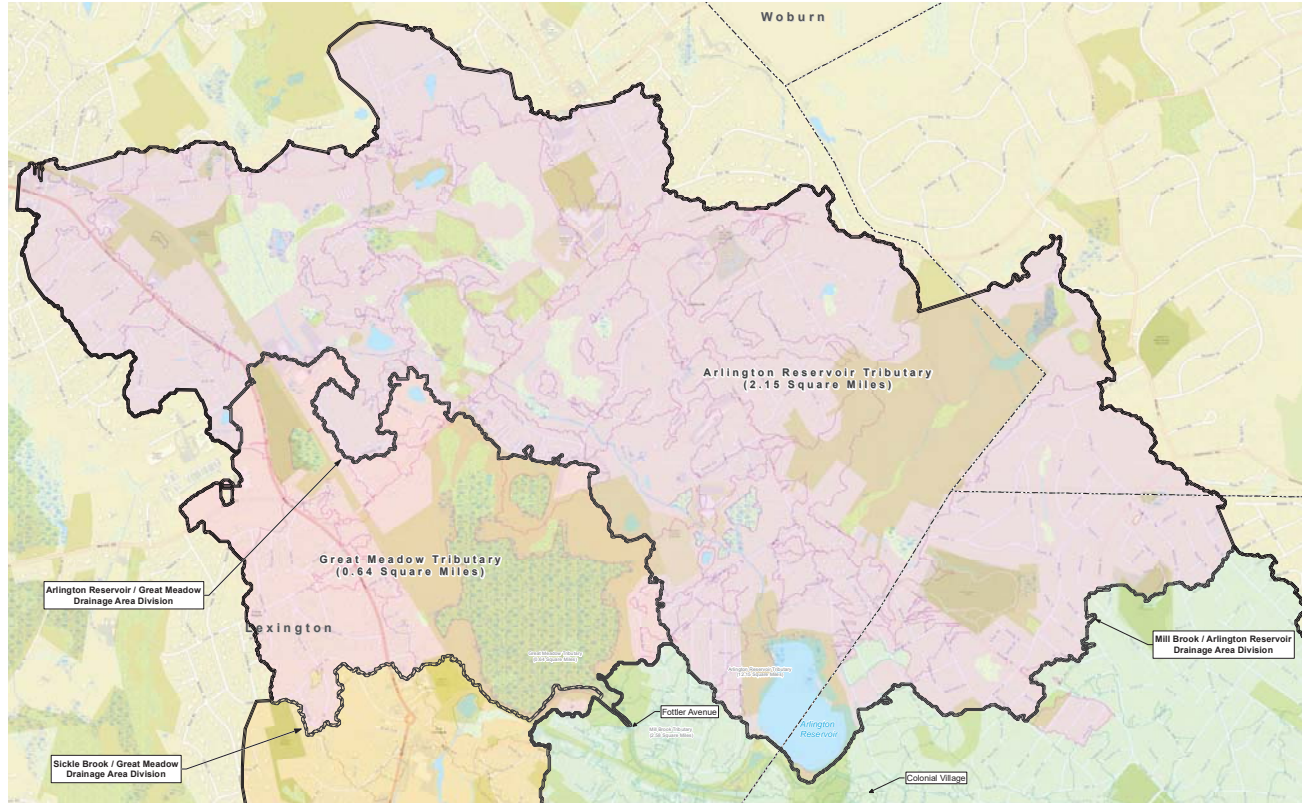
The following sections provide a brief overview of the Arlington Reservoir's watershed, geometry, and surficial recharge and flow characteristics. This report was completed in conjunction with Dr. Ken Wagner of Water Resource Services, who conducted much of the in-pond evaluation.

BRIEF HISTORY OF ARLINGTON RESERVOIR'S IMMEDIATE WATER FLOWS

As noted in the "Existing Conditions" section, the reservoir is impounded by a dam along its southern and western edges. Munroe Brook enters from Lexington in the northwest and feeds the reservoir. Munroe Brook is considered perennial, meaning that it runs year-round. The reservoir discharges via a dam and gate system to Sickie Brook at its confluence with Mill Brook, which then flows through Arlington Heights roughly parallel to the Minuteman Bikeway. The Res supports several species of fish, amphibians, reptiles and many species of birds.

ARLINGTON RESERVOIR WATERSHED

The Arlington Reservoir Watershed comprises just less than 1,400 acres. The map below depicts the approximate boundary of Arlington Reservoir Watershed based on surface topography, although the storm drains on Mount Gilboa direct water elsewhere. This watershed map was created with Geographic Information System (GIS) mapping technology and accounts for flow into stormwater infrastructure and surficial flow into ponds and rivers. The watershed contains approximately 77% pervious surface and 23% impervious. Residential land use comprises just over 52% of the watershed, forest takes up approximately 28%, and wetland is just shy of 8%. The remaining 12% is a mix of institutional, waterbodies, nursery, commercial, open land, cemetery, and cropland, ordered from largest (42 acres) to smallest. (5 acres)



Arlington Res Watershed (c. 2017)

As a technical rule of thumb, watersheds of less than ten times the surface area of their receiving water tend to be lesser pollutant influences, while watersheds of greater than 50 times the area of their receiving water tend to be dominant influences. The tendency is even stronger when the watershed is more urbanized. The Arlington Reservoir Watershed is about 46 times the area of the Res. Water quality issues should be expected in the reservoir given the relative concentration of urban development in its watershed and considering that the watershed's relative size to the waterbody itself.

SIZE, DEPTH, AND RELATED OBSERVATIONS

The image on the following page provides a bathymetric (i.e., depth-contour) map of the Arlington Reservoir. To determine the bathymetry of the reservoir, a total of 50 water depth measurements were collected over the 26 acres. The water level was about 1.5 feet below normal full pool (seasonal drawdown), so the field measurements were corrected to derive water depths at full pool status. Maximum depth is approximately 7 feet, while average depth is 3.8 feet. The total volume of the reservoir is approximately 99 acre-feet, or 32.3 million gallons, or 122,200 cubic meters.

The bottom of the reservoir is somewhat bowl-like, but not completely regular. There is a shallow area on the west side that does not seem to correlate to any inlet point adding sediment; this area is rocky to sandy, suggesting the condition may have been present when the reservoir was constructed in 1871. There is another sandy area in the northeastern part of the reservoir, slightly north of the bermed swimming area, and another directly south of the swim area and west of the parking lot. While much of the bottom is covered by organic matter, which primarily includes decayed plant remains, deposits were not deep.

The normal outlet is located on the reservoir's southwestern side and has a sluice gate that operates a six-foot opening between elevation 153.0 and 159.0. A larger overflow spillway is located on reservoir's southeastern shoreline. The first section of Mill Brook is the connector channel between the two outlets outside of the southern margin of the reservoir.

In terms of refill and drawdown schedule, the reservoir elevation is raised in the spring by May 1st, when practical with respect to heavy rain events, and/or after the bathing beach has been graded at the water line. In the past, an elevation of 158.5 has been obtained for proper function of the swimming area filtration system and facilitating the water vegetation harvesting operations in July. The reservoir elevation is lowered soon after the last official day of swimming at the beach area or when practical with respect to heavy rain events. The lowest elevation obtained is near 153.0. The sluice gate may be raised and or lowered at other times during the year for storm runoff storage or drawdown as needed, such as during a heavy rain event.



Arlington Res Bathymetry

SURFICIAL RECHARGE, FLOW AND EFFECTS ON WATER QUALITY

Based on our review of watershed data and observations during fieldwork, Munroe Brook appears to be Arlington Reservoir's principal surficial source of recharge. Flowing from the northern reaches of the watershed, Munroe Brook discharges to the northwest corner of The Res. The Res certainly receives overland flow, but this is most likely a secondary source of recharge compared to Munroe Brook. During site visits for this project, there were three stormwater outfalls (i.e., discharge pipes) observed on the reservoir's perimeter, which are noted on the analysis diagram on page 29. These outfalls are in poor condition or completely broken and should be evaluated for replacement as part of the improvements to The Res. The area surrounding the outfalls are also severely eroded. Due to uncooperative weather conditions, wet-weather testing was not conducted as part of this master plan effort. It is recommended that this testing is completed during the first phase of improvements made to The Res in order to better understand how the existing stormwater outfalls relate to water quality.

Water Quality during Dry Weather

Users of The Res depend on a healthy waterbody to support swimming and fishing as well as enjoyment of local wildlife and being outdoors. Water quality was assessed during dry-weather conditions with the following goals in mind:

- Managing the overall ecological health of The Res. It should be noted that low water at different times of the year is critical for some species. Certain birds such as sandpipers, dabbling ducks, and herons need the shallows and mudflats, which are conditions present at the reservoir during times of low water levels.
- Ensuring support of existing recreational uses as well as anticipated growing demand following improvements completed at The Res.
- Mitigating the threat and adverse effects of urbanization.

The water quality discussion below provides the results of Weston & Sampson's dry-weather sampling program.

APPROACH AND METHODS

Sampling was conducted at three in-reservoir stations (WQ-1 to WQ-3) sited approximately equidistant from each other between the outlet of Munroe Brook and the outlet of The Res at the dam spillway, as marked on the map below:



Sampling Stations

Table 1. Water Quality Station Locations	
Water Quality Station	Approximate Geolocation
WQ-1	-71.189131 42.430523
WQ-2	-71.189298 42.428963
WQ-3	-71.188911 42.427379

Sampling included the following parameters, methods and equipment:

Table 2. Sampling Parameters, Methods, and Equipment			
Parameter	Methods	Equipment	Reporting Limits
Water temperature	In the field, by probe	Meter and probe	N/A ¹
Dissolved oxygen	In the field, by probe	Meter and probe	N/A
Specific conductivity	In the field, by probe	Meter and probe	N/A
pH	In the field, by probe	Meter and probe	N/A
Turbidity	121, 2130B	Plastic 500 mL, unpreserved	0.20 NTU
Chloroform	In the field, by florescence probe	Meter and probe	N/A
Alkalinity	In the field, by probe	Meter and probe	N/A
Phosphorous (soluble)	121, 4500P-E	Plastic 250 mL, H2SO4 preserved, filtrates	0.010 mg/L
Phosphorous (total)	121, 4500P-E	Plastic 500 mL, H2SO4 preserved	0.010 mg/L
Nitrogen (ammonia-N)	121, 4500NH3-BH	Plastic 500 mL, H2SO4 preserved	0.075 mg/L
Nitrogen (nitrate-N)	121, 4500NO3-H	Plastic 500 mL, H2SO4 preserved	0.100 mg/L
Nitrogen (total Kjeldahl nitrogen)	121, 4500NH3-H	Plastic 500 mL, H2SO4 preserved	0.300 mg/L
Clarity	Secchi Disk Method	Horizontal Secchi disk	N/A

Notes:

1. "N/A" means not applicable as measurements were done in the field without laboratory reporting.

All field instruments were calibrated and cleaned as needed in accordance with manufacturer's instructions.

Alkalinity and Secchi disk measurements were conducted at WQ-2 only. Sampling for phosphorus and nitrogen was conducted at a depth of 0.2 meters.

WEATHER CONDITIONS

Dry-weather water quality sampling of The Res was conducted on September 27, 2017. Water quality sampling was conducted approximately between 11:00 a.m. and 1:00 p.m. During the water quality sampling process, weather conditions ranged from clear to partly cloudy with wind speeds of 6.9 to 11.5 miles per hour, as reported at Hanscom Airport in Bedford, Massachusetts. Air temperature ranged from approximately 82.9 – 86.0°F (28.3 – 30.0°C).

FINDINGS

The three tables below summarize the results of dry-weather water quality sampling, all collected on September 27, 2017:

Table 3. Water Quality Field Measurements for Arlington Reservoir										
Station	Date	Time (military, EST)	Depth (m)	Temp (°C)	Dissolved Oxygen		Spec. Cond. (µS/cm)	pH	Turbidity (NTU)	Chlorophyll (µg/L)
					(mg/L)	% Sat.				
WQ-1	9/27/17	12:46:23	0.2	23.0	7.1	83.9	649	6.8	3.1	2.7
	9/27/17	12:47:18	0.5	21.2	6.0	68.2	637	6.9	3.6	4.8
	9/27/17	12:47:56	1.0	20.1	3.3	37.2	645	6.8	9.9	12.5
WQ-2	9/27/17	12:56:11	0.4	23.0	7.9	93.5	671	6.9	17.5	7.0
	9/27/17	12:58:39	1.0	20.3	1.9	21.7	683	6.9	16.8	10.3
WQ-3	9/27/17	13:08:56	0.3	22.8	2.7	31.4	812	6.8	13.0	2.0

Table 4. Alkalinity and Secchi Measurements for WQ-2 at Arlington Reservoir	
Alkalinity (mg/L)	Secchi Depth (m)
46	1.3

Table 5. Laboratory Measurements for Arlington Reservoir							
Station	Date	Depth (m)	Phosphorus		Ammonia-N (mg/L)	Nitrate-N (mg/L)	Total Kjeldahl Nitrogen (mg/L)
			Soluble (mg/L)	Total (mg/L)			
WQ-1	9/27/17	0.2	ND ¹	ND	ND	ND	0.518
WQ-2	9/27/17	0.2	0.010 ²	ND ²	ND	ND	0.402
WQ-3	9/27/17	0.2	ND	0.022	ND	ND	0.483

Notes:

1. "ND" means non-detect in the laboratory analysis and reflects a value that is zero or less than the reporting limit.
2. Logically, total phosphorus should be equal to or greater than soluble phosphorus. Soluble phosphorus and total phosphorus were assessed by Alpha labs, both with detection limits of 0.010 mg/L. Methods for lab analysis of these constituents involved different processes that tend to be less reliable at the detection limit. It is likely that total phosphorus is approximately 0.010 mg/L and made up almost entirely of the soluble fraction.
3. Phosphorus and nitrogen samples were analyzed by Alpha Analytical in Westborough, MA and reported on October 4, 2017.

Laboratory water quality measures suggest relatively low nutrient concentrations, somewhat of a surprise in light of watershed features and high apparent productivity in the reservoir. Total phosphorus was low to moderate and dissolved phosphorus was detectable in only one sample. Values declined from inlet to outlet, suggesting that the reservoir sediment is a large sink for phosphorus. Nitrate and ammonium nitrogen were undetectable in all samples. The total Kjeldahl nitrogen, which is the combination of ammonium nitrogen and digestible organic nitrogen, was moderate at 0.4 to 0.5 mg/L. One would not expect algae blooms to be supported by water column nutrients in the reservoir based on these results, but they represent only a single sampling after a period of dry weather with the reservoir undergoing drawdown. It would appear that primary production in the reservoir depends on sediment sources of nutrients, and with the shallow depth, rooted plants can grow anywhere, and algae could grow at the sediment-water interface and rise in the water column to form blooms without elevated nutrient levels in the water column.

Results indicate that the reservoir is stratified, which was not observed ten years ago in the report titled "Arlington Ponds 2007 Baseline Survey" (Appendix G). Dissolved Oxygen was high (near or at saturation) in prior measurements and is now only high at the surface and decreases significantly at depth. There are also potentially significant changes in turbidity from 2007 to 2017. Any turbidity values over 10 ntu are considered high/turbid and will affect the ability of the waterbody to support organisms. As part of this study, results for turbidity at location WQ-2 were very high at 17.5 and 16.8 ntu. Such significant changes in a ten-year span means that more study should be considered on a biannual basis (spring and fall). With the amount of data collected in 2017, it is difficult to draw reliable conclusions about changes from 2007 to 2017.

No analysis of *E. coli* was conducted as part of this study; however, since swimming occurs only in designated areas that are chlorinated, *E. coli* should not be an issue at The Res. As part of the maintenance and monitoring consideration described later within this report, a bathing beach monitoring program under the Board of Health should be implemented that addresses *E. coli*.

Aquatic Habitat

The Res provides habitat for many native plants and animals. There is a rising concern that invasive species are infiltrating The Res and pushing out native species. The Res was assessed for aquatic plants and animals to address the following purposes:

- Identify habitat functions and values provided by The Res.
- Create an inventory of native aquatic plants and animals.
- Create an inventory of invasive aquatic plants and animals that may threaten the overall aquatic health of The Res.

The discussion below provides the results of our field assessment of aquatic habitat.

APPROACH AND METHODS

The following section provides a discussion of sampling and analytical methods for assessing aquatic habitat.

Phytoplankton - Sampling for phytoplankton was conducted on September 27, 2017 between approximately 11:00 a.m. and 1:00 p.m. by Water Resources Science. Phytoplankton were collected from just below the surface (approximately 0.5 feet), avoiding surface scum to the extent practicable, at WQ-2, the central station used for water quality sampling, as it appeared to provide a representative sample. A whole water sample was collected in a 250 mL bottle and preserved with glutaraldehyde to a concentration of 0.5%. The sample was settled in the lab and concentrated before quantitative examination under phase contrast optics at 200-400X. The final multiplication factor for cells observed to cells/mL of raw sample was less than 25.

This analysis was done with a single sample. Results from sampling tend to vary seasonally. While a single sample can provide a meaningful starting point in assessing the overall condition of a surface water, a more comprehensive sampling program would provide more complete and reliable data on which to make management decisions.

Zooplankton - Sampling for zooplankton was conducted on September 27, 2017 between approximately 11:00 a.m. and 1:00 p.m. by Water Resources Science. Zooplankton were collected by towing a net with 80 µm mesh through 30 meters of water from the same station where phytoplankton were collected. With a net diameter of 5 inches, this results in 380 liters of water being filtered. The sample was preserved with glutaraldehyde at a concentration of 2%, settled in the lab, and quantitatively examined under phase contrast optics at 100X magnification. The final multiplication factor for converting observed specimens to density per liter was less than 1.

Aquatic Flora and Fauna - A survey of flora and fauna was conducted on September 27, 2017 between approximately 11:00 a.m. and 1:00 p.m. by Water Resources Science as part of an overall review of watershed and reservoir conditions.

Analysis - Taxonomy for phytoplankton, zooplankton, and cyanobacteria was conducted by Water Resources Science.

WEATHER CONDITIONS

Field data for the aquatic habitat assessment was collected on September 27, 2017 simultaneously with water quality data. Survey conditions are discussed above within the discussion on water quality during dry weather.

FINDINGS

Plankton - This discussion addresses both phytoplankton and zooplankton. Analysis of phytoplankton (algae in the water column) suggests that green algae (chlorophyte) are most abundant in Arlington Reservoir (Table 6) and that cyanobacteria are uncommon. This is consistent with the laboratory water quality data, which suggest a high ratio of nitrogen to phosphorus, which tends to favor growth of green algae. Other algal groups were represented but not abundant and total biomass was moderate to low. Biomass values in excess of 10,000 µg/L are very high, while values <1000 µg/L are considered low. Between 1000 and 3000 µg/L algae issues become more noticeable with variation based on the types of algae dominating. The algae found during our assessment do not represent a threat to human health or ecological integrity; however, this finding is based on only one sample. Notwithstanding the limited nature of the sampling program, data was at a time of year when problems are generally most evident in waterbodies; therefore, our findings indicate low likelihood of algae problems.

Table 6. Phytoplankton Data for Arlington Reservoir at WQ-2 (Collected: September 27, 2017)		
Taxon	Cell Count (cells/mL)	Biomass (µg/L)
BACILLARIOPHYTA		
Centric Diatoms		
Cyclotella	40	4.0
Araphid Pennate Diatoms		

Table 6. Phytoplankton Data for Arlington Reservoir at WQ-2 (Collected: September 27, 2017)		
Diatoma	13	18.6
Fragilaria/related taxa	160	47.9
Biraphid Pennate Diatoms		
Cymbella/related taxa	27	26.6
Epithemia	13	63.8
Gomphonema/related taxa	13	13.3
Navicula/related taxa	27	13.3
CHLOROPHYTA		
Cocoid/Colonial Chlorophytes		
Ankistrodesmus	27	2.7
Elakatothrix	27	2.7
Scenedesmus	53	5.3
Desmids		
Closterium	13	53.2
Cosmarium	27	21.3
Euastrum	40	39.9
Micrasterias	13	532.0
Onychonema	705	704.9
Pleurotaenium/related taxa	7	266.0
Straurastrum	27	21.3
Staurodesmus	13	8.0
CYANOPHYTA		
Filamentous Non-Nitrogen		
Limnographis	133	26.6
EUGLENOPHYTA		
Trachelomonas	120	119.7

Table 7. Phytoplankton Data for Arlington Reservoir at WQ-2 Density Summary (Collected: September 27, 2017)		
Taxon	Cell Count (cells/mL)	Biomass (µg/L)
BACILLARIOPHYTA	292.6	187.5
Centric Diatoms	39.9	4.0
Araphid Pennate Diatoms	172.9	66.5

Table 7. Phytoplankton Data for Arlington Reservoir at WQ-2 Density Summary (Collected: September 27, 2017)		
Monoraphid Pennate Diatoms	0	0.0
Biraphid Pennate Diatoms	79.8	117.0
CHLOROPHYTA	950.95	1657.1
Flagellated Chlorophytes	0	0.0
Coccoid/Colonial Chlorophytes	106.4	10.6
Filamentous Chlorophytes	0	0.0
Desmids	844.55	1646.5
CHRYSOPHYTA	0	0.0
Flagellated Classic Chrysophytes	0	0.0
Non-Motile Classic Chrysophytes	0	0.0
Haptophytes	0	0.0
Tribophytes/Eustrigmatophytes	0	0.0
Raphidophytes	0	0.0
CRYPTOPHYTA	0	0.0
CYANOPHYTA	133	26.6
Unicellular and Colonial Forms	0	0.0
Filamentous Nitrogen Fixers	0	0.0
Filamentous Non-Nitrogen	133	26.6
EUGLENOPHYTA	119.7	119.7
PYRRHOPHYTA	0	0.0
TOTAL	1496.25	1990.9
CELL DIVERSITY	0.88	0.84
CELL EVENNESS	0.65	0.64

Cell diversity, noted above in Table 7 and below in Table 11, is a measure of the distribution of cells or biomass among the taxa present. Higher values indicate a more even distribution, such that no one taxon is dominant. The diversity value is dependent on the number of taxa present, has no clear upper or lower limit, and can be difficult to interpret. Evenness is calculated as the measured diversity divided by the diversity value that would have been achieved if all cells or biomass were evenly divided among all taxa present. It is assessed on a scale of 0 to 1. Values in excess of about 0.8 are rare; cells and biomass are not often so evenly distributed among taxa. Values from 0.6 to 0.8 indicate a fairly even distribution, while values <0.3 suggest that a few taxa are dominant. In cases of algae blooms, one taxon can dominate and evenness values can be <0.1. The value for the reservoir sample suggests no dominance by any algal taxon.

Zooplankton in the Res were found to be generally scarce, as shown in Table 8 below, with commonly found groups represented but overall low biomass. No large-bodied forms were present and average

body size was low, which is indicative of intense predation by small fish. At the time of year of the assessment, biomass is typical at its lowest point as a consequence of predation by small fish during the summer, however the values Weston & Sampson found actually suggest a minimal food base for small fish and very little capacity for the zooplankton to graze algae and keep them under control. A spring sample would help assess overall zooplankton features, but based on the sample collected under this assessment, the zooplankton community is sub-optimal.

Table 8. Zooplankton Data for Arlington Reservoir at WQ-2 (Collected: September 27, 2017)		
Taxon	Count (individuals/L)	Biomass (µg/L)
PROTOZOA		
Ciliophora	0.0	0.0
Mastigophora	0.0	0.0
Sarcodina	4.7	0.1
ROTIFERA		
Asplancha	2.4	2.4
COPEPODA		
Copepoda-Cyclopoida		
Cyclops	0.8	1..9
Copepoda-Calanoida		
Diaptomus	2.4	3.7
CLADOCERA		
Alona	1.6	4.7
Bosmina	6.3	6.2
Ceriodaphnia	4.7	12.3
Chydorus	5.5	5.4
OTHER ZOOPLANKTON	0.0	0.0

Table 9. Zooplankton Data for Arlington Reservoir at WQ-2 Density Summary (Collected: September 27, 2017)		
Taxon	Count (individuals/L)	Biomass (µg/L)
PROTOZOA	4.7	0.1
ROTIFERA	2.4	2.4
COPEPODA	3.2	5.6
CLADOCERA	18.2	28.6
OTHER ZOOPLANKTON	0.0	0.0

Table 9. Zooplankton Data for Arlington Reservoir at WQ-2 Density Summary (Collected: September 27, 2017)		
TOTAL DENSITY	28.5	36.7

Table 10. Zooplankton Data for Arlington Reservoir at WQ-2 Summary of Richness (Collected: September 27, 2017)	
Taxon	Types Observed
PROTOZOA	1
ROTIFERA	1
COPEPODA	2
CLADOCERA	4
OTHER ZOOPLANKTON	0
TOTAL RICHNESS	8

Table 11. Zooplankton Data for Arlington Reservoir at WQ-2 Summary of Diversity, Evenness and Length (Collected: September 27, 2017)	
Shannon-Wiener Diversity Index	0.84
Evenness Index	0.93
Mean Length All Forms (mm)	0.36
Mean Length Crustaceans (mm)	0.43

Aquatic Plant Community - The rooted plant community is a dominant feature of The Res and is comprised primarily with three species: water chestnut (*Trapa natans*), Eurasian watermilfoil (*Myriophyllum spicatum*), and coontail (*Ceratophyllum demersum*). The first two are invasive species, and although coontail is native, it has been known to reach nuisance densities. A few other species are present, either as sparse or moderate density growths, including spiny naiad (*Najas minor*), curly leaf pondweed (*Potamogeton crispus*), spiral pondweed (*Potamogeton spiralis*), burreed (*Sparganium* species), and aquatic clover (*Marsilea quadrifolia*). Both the spiny naiad and curly leaf pondweed are invasive species and, while aquatic clover is not native, it does not reach nuisance densities that would qualify it as an invasive species. The rooted plant community of The Res is half invasive species by taxonomic breakdown, but much more than half by biomass.



Water chestnut



Eurasian Watermilfoil



Coontail

Filamentous green algae, including both *Spirogyra* and *Cladophora*, form mats among the submergent rooted plants. Benthic cyanobacteria mats, most likely *Oscillatoria*, were also observed. None of these algae were detected in plankton samples; however, floating watermeal (*Wolffia columbiana*) was observed as a sparse surface cover and gets its nutrition from the water column like most planktonic algae. Peripheral growths of cattail (*Typha latifolia*) were also observed but form only a narrow fringe at the edge of the reservoir and do not seem to represent any threat at this time.

It is apparent that water chestnut could take over most of the reservoir, but that annual mechanical harvesting has kept it largely in check. However, the Town reported that harvesting is typically completed in late summer after seeds have been deposited. As a result, the ability to have long-term benefits from harvesting is diminished. If harvesting was conducted before seeds were produced, water chestnut can eventually be controlled or even eliminated over time. In the portions of the reservoir not dominated by water chestnut, milfoil and/or coontail are very abundant.

Given that this survey was conducted in late September, it is possible that other species were more abundant earlier in the growing season, most notably curly leaf pondweed, which tends to peak in late spring and die back over the summer. The Res has multiple plant problems that represent the most obvious threat to its designated uses. With a maximum depth of 7 feet, there is no place in the reservoir where plants cannot grow due to depth/light limitations. Only a few areas have coarser substrate that limits plant density. If not for the mechanical harvesting program, water chestnut

might cover nearly all the reservoir. While a substantial amount of plant life can provide desirable habitat for many forms of water-dependent life, the aquatic plant community of The Res is likely to foster ecological imbalance and must be thinned or replaced to provide optimal habitat for those that rely on this waterbody for their survival.



Curly leaf pondweed

Review of photographic evidence dating to the 1990s indicates that water chestnut has been a dominant feature of the plant community for about twenty years or even longer. Weather and management efforts may have varied somewhat, but it should be noted that plant nuisances have plagued The Res for many years.

Aquatic Fauna and Related Habitat - No invertebrate studies were conducted, but the normal complement of invertebrate species was observed, including beetles, dragonflies, damselflies, true bugs, and various fly larvae. Benthic samples were not collected, but it seems very likely that blood chironomids (midges adapted to life with minimal oxygen) would be abundant. No mussels or snails were observed, but collection was limited. Mayflies, stoneflies and caddisflies were not observed, but the nature of the habitat (both plants and water quality) would be expected to minimize those desirable invertebrates.

Fish were not studied explicitly in this investigation, but largemouth bass and bluegill sunfish were observed, which are introduced non-native species. The fish assemblage is typical for the waterbody, but specimens are likely to have low condition factors because of overabundant vegetation. Sunfish are protected from predation by the dense plant growths, leading to overpopulation by that species and small mean size. Inability of bass to feed effectively on small sunfish leads to slower growth rates and possible reproductive failure. Reduced vegetation density would improve the fishery as well as other aspects of the reservoir. Additionally, the oxygen readings suggest that fish may be stressed in water deeper than about three feet, and that visibility is limited by suspended organic matter. A reduction in organic matter production, again linked to plant productivity, would be beneficial. No analysis of fish was conducted to understand if the fish are safe to eat; however, the Arlington Reservoir is an urban waterbody that collects pollutants from a number of different sources upstream, so it should be assumed that no fish should be eaten unless samples are tested to understand if the fish are safe for consumption. At this time, fishing should be catch-and-release only.



Largemouth bass



Painted turtles

A lack of emergent native aquatic vegetation does not fully support the habitat needs of amphibians. Painted turtles were observed in late September 2017 and large snapping turtles can often be seen, especially in the spring. Not many frogs were observed during this time period, but there was no obvious reason why a wider variety were not found. There have been regional issues with frog populations declining, but any relation to The Res is unknown. Residents have reported that amphibians were observed in April 2018, although quantities were not reported.

There is an abundance and diversity of bird life that draws avid birders to The Res and its immediate surroundings. According to the report, "Updated Notes on the Importance of Arlington Reservoir to Birds and to the Arlington Community," by resident and birder Karsten E. Hartel (Appendix E), over 200 species of birds have been recorded around The Res, which is an important migratory area for many waterbirds and the surrounding uplands provide fair to good habitat for songbirds. Some species observed include the green-winged teal, mallard duck, great blue heron, the red-tailed hawk, the mourning dove, the killdeer and the blue jay to name a few. A bald eagle was been spotted by visitors near The Res at Rindge Park. Swans, mallard ducks, Canada geese and great blue herons were observed on September 27, 2017.

The seasonal fluctuation in water level creates habitat for a diverse range of birds; the deep end draws diving ducks and grebes. Shorebirds, dabbling ducks, and herons inhabit the weeds and mudflats in the shallow areas. When the water level is low, the shallow water deposit just south of the bathing beach becomes visible and frequented by ducks and geese. There are no other habitats quite like these in Arlington, especially given the proximity of Lex Farm and Cataldo Reservation which provide valuable open habitat and flowing water, thickets and understory, respectively. There is no shortage of food for a variety of waterfowl in The Res, although birds may have some difficulty accessing some food resources among dense vegetation.



Great Blue Heron



Red-tailed Hawk



Killdeer

Many forms of water-dependent wildlife can thrive in dense plant communities, but most prefer some mid-range of abundance and both richness, or number of species, and diversity, or distribution of individuals among species, would be maximized with a wider range of habitats. This translates into a reduction in plant density and dominance by just a few species.

Invasive Terrestrial Plants Survey

As mentioned above, there is a rising concern that invasive species are infiltrating The Res and pushing native species out. Invasive terrestrial plants are also restricting habitat while adversely affecting recreational opportunities. The study area surrounding the reservoir was assessed for presence of invasive plants and to meet the following goals:

- Identify types of invasive plants.
- Create an inventory of the extent of invasive plants.
- Create an inventory of invasive plants that may threaten recreation, wetlands and terrestrial habitat.

The discussion below provides the results of our field assessment of invasive terrestrial plants.

APPROACH AND METHODS

The presence of invasive species was explored on both sides of the walking path that surrounds the Res, except for the beach area which was secured with a perimeter fence and locked gate, since this the area was closed for the season. Along the walking path, the beginning and ending locations of the invasive species were marked using green flagging. Each flag was provided a unique number which followed the "INV" naming scheme (i.e., the first invasive species flag was labelled "INV-1," the second labelled "INV-2," etc.). The name of each pair of flags was recorded in a field notebook along with the types of invasive species found within the area. The locations of the invasive species

flags were recorded by a survey team. The locations of the flags were later converted to CAD format to be placed on the topographic survey, which has been provided in Appendix J. Additionally, locations are graphically represented on the Environmental Findings diagram on page 11.

WEATHER CONDITIONS

A site field survey of the Res was conducted on August 28, 2017 for invasive plants. The survey was conducted between approximately 10:00 a.m. and 3:00 p.m. Weather conditions during the survey, as reported by Weather Underground at Hanscom Airport in Bedford, Massachusetts, ranged from clear to partly cloudy with wind speeds of 4.6 to 13.8 miles per hour. Air temperature ranged from approximately 68.0 – 77.0.10F (20.0 – 25.00C).

FINDINGS

Several different types of invasive species were noted in the study area. These include:

- Garlic mustard (*Alliaria petiolata*)
- Japanese barberry (*Berberis thunbergii*)
- Asian bittersweet (*Celastrus orbiculatus*)
- Winged euonymus (*Euonymus alatus*)
- Glossy buckthorn (*Frangula alnus*)
- Morrows honeysuckle (*Lonicera morrowii*)
- Purple loosestrife (*Lythrum salicaria*)
- Japanese knotweed (*Polygonum cuspidatum*)
- Multiflora rose (*Rosa multiflora*)

Although other invasive species may be present on site, eight of these species were observed on August 28, 2017 in the largest abundance . While this study focused on the larger shrubs, trees and vines, garlic mustard is very common in this area, has been observed by visitors to The Res and members of the Reservoir Working Group, and thus added to the list of invasive species found at The Res. Large stands of Japanese knotweed were noted in the southeastern part of the property with smaller instances near the dam spillway and the northeastern side of the site. Asian Bittersweet was found throughout the site, as was Japanese barberry and multiflora rose. The heaviest population of winged euonymus was noted on the north-eastern edge of the site. Purple loosestrife was noted in the wetland resource area downgradient of the dam and at the reservoir's edge. Additionally, while not invasive, poison ivy (*Toxicodendron radicans*) has been observed and has been a nuisance in some areas of the property.

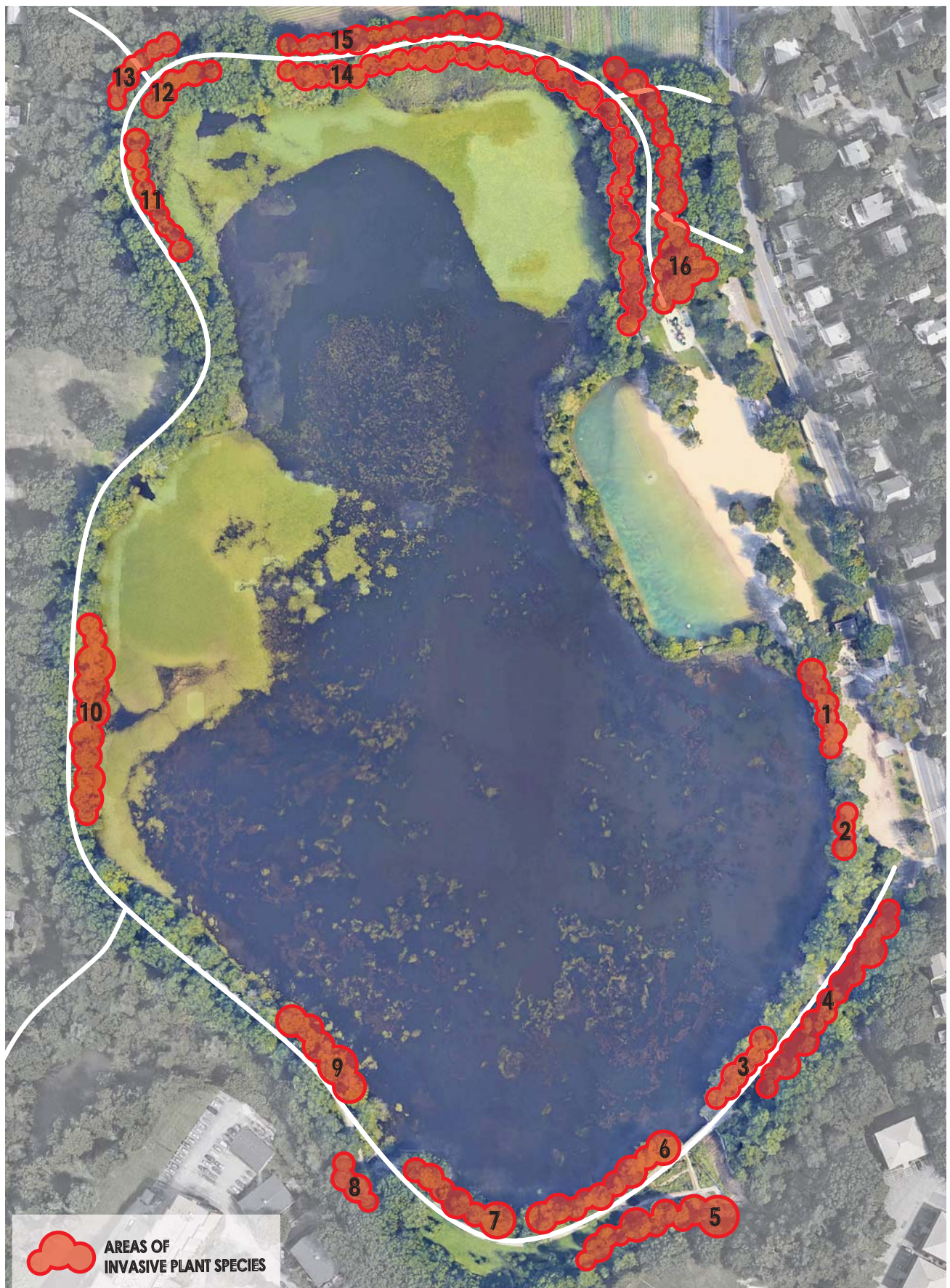


Diagram indicating observed invasive plant species per area, which related to the areas noted in Table 12

The preceding diagram and table below indicate the specific species observed in the numbered areas around The Res:

Table 12. Invasive Species Observed Along the Perimeter Trail (August 28, 2017)									
Area	Japanese Barberry	Asian Bittersweet	Winged Euonymus	Glossy Buckthorn	Morrows Honeysuckle	Purple Loosestrife	Japanese Knotweed	Multiflora Rose	Tree of Heaven
1									
2									
3									
4									
5									
6									
7									
8									
9									
10									
11									
12									
13									
14									
15									
16									

A brief description of each species is included below:

Japanese barberry (*Berberis thunbergii*) is a dense, thorny shrub that grows between two and eight feet tall. Leaves grow alternately along the stem, are elliptical in shape, and are usually no larger than five inches in length. Bright red, elliptical berries can be seen between July and October. This species prefers full sun, but can also survive in heavily shaded areas.



Japanese barberry



Asian bittersweet (*Celastrus orbiculatus*) is a fast-growing woody vine that grows up to 60 feet long and can quickly shade out native plants. Juvenile stems appear brown with warts but change to gray-barked when older. Leaves are alternately arranged. Bright yellow/orange fruit are spread by birds and other animals. This species can grow in full sun to partial shade conditions.



Asian bittersweet



Winged euonymus

Winged euonymus (*Euonymus alatus*) is a shrub that is usually between five and ten feet tall and wide. This species is easily identifiable because of its wings along its branches. Leaves are elliptical, one to three inches in length, and are arranged oppositely along the stem. In the fall, the green leaves turn to brilliant shades of red and purple. This shrub can grow in full sun to full shade conditions.

Glossy buckthorn (*Frangula alnus*) is a shrub or small tree that can grow up to twenty feet in height. The gray/brown bark is smooth with white specks throughout. The usually elliptical shaped, dark green leaves are alternately arranged and are one to two-and-a-half inches in length. Small, round fruits change color from red to black as they ripen between July and October. Glossy buckthorn can grow in full sun and full shade alike.



Glossy buckthorn



Morrow's honeysuckle

Morrows honeysuckle (*Lonicera morrowii*) is a multi-stemmed shrub that can grow up to seven feet tall. The elliptical leaves are approximately one to two inches in length and grow oppositely along the stem. The leaf is hairy underneath. White flowers are made of five separate petal lobes and are seen in April or May. This species is mostly spread with the aid of birds ingesting the seeds and dropping them elsewhere.

Purple loosestrife (*Lythrum salicaria*) is a perennial herb that grows up to five feet tall. The erect-growing stems are four- to six-sided and can be quite hairy. Leaves are located oppositely or in whorls along the stem. Magenta colored flowers in clusters form colorful spikes from July through September. This species prefers moist soils and is often found in wetlands areas. Mature plants can produce an estimated 2.5 million seeds in a year that can persist in wet soils for years, ultimately forming vast, dense stands that restrict native plant species.



Purple loosestrife



Japanese knotweed

Japanese knotweed (*Polygonum cuspidatum*) is classified as a perennial herb which is often confused as bamboo. The plant grows upright to ten feet high. The stems are round and hollow. Leaves measure up to seven inches long and four inches wide with sharp tips. White or greenish colored flowers appear in August and September in numerous, branched clusters. Japanese knotweed is adaptive to its environment, being able to grow in full sun and full shade. This species spreads both by budding from roots and by seed. It grows in dense thickets.

Multiflora rose (*Rosa multiflora*) is a shrub with stems that may attain ten to fifteen feet in length. The stems are red to green with thorns. Clusters of white, or sometimes pink, five-petal flowers appear between May and June. This species can adapt and grow in full sunlight to full shade and tolerates a wide variety of moisture conditions.



Multiflora rose



Garlic mustard

Garlic mustard (*Alliaria petiolata*) is a biennial shade-loving herb. It is most often found in the forest understory or along forest edges and tolerates low light levels. Populations of garlic mustard can spread rapidly and advance about twenty feet per year or more. In the first year, seeds germinate in the spring and form low growing rosettes of dark purple to green, kidney-shaped leaves with scalloped edges. Young leaves smell distinctly of garlic or onion when crushed; the odor becomes less intense as plants grow older. Leaves on second year plants are roughly triangular and sharply toothed, a little over one to three inches wide and long, and become gradually smaller towards the top of the stem.

Wetlands Survey

The area surrounding the Res includes substantial areas of wetlands. Wetlands are protected under the Massachusetts Wetlands Protection Act. Wetlands also provide significant ecological, recreational, and water quality functions and values. Wetlands in the study area were assessed with the following goals:

- Creating an inventory of existing wetlands type and extent.
- Delineating wetlands for protection during operation and improvement of The Res property.

The discussion below provides the results of our field assessment of wetland species. The wetlands field map and MassDEP Bordering Vegetated Wetland Delineation Field Data Forms are included as Appendix L.

APPROACH AND METHODS

Wetland resources were identified in the field by a certified PWS, who is trained in the wetland delineation process using the Massachusetts Department of Environmental Protection (MassDEP) manual, Delineating Bordering Vegetated Wetlands Under the Massachusetts Wetlands Protection Act, and the US Army Corps of Engineers Wetland Delineation Manual. The locations of the flags were later converted to CAD format and placed on the topographic survey (Appendix J).

WEATHER CONDITIONS

A wetlands survey of The Res was conducted on August 28, 2017 for wetlands resources simultaneously with the invasive plants survey. Weather conditions are discussed in the previous section.

FINDINGS

The Res comprises approximately 24.5 acres in area of land under water. It is surrounded by approximately one mile of bank, all of which is considered steep, allowing for little bordering vegetated wetland (BVW) associated with the reservoir. Based on our survey, wetland areas in the

study area include a constructed wetland east of the Wildlife Habitat Garden, BVW along Munroe, Mill Brook and Sickle Brook, perennial streams (Munroe and Mill Brook) and land under water. The discussion below provides a detailed description of wetland resources in the study area:

Bordering Vegetated Wetlands (BVW) - One BVW area was identified at the site, located south of the Arlington Reservoir dam along Mill Brook. The BVW along Monroe Brook was considered to be outside of the project limits. Wetland flags left in the field to identify this BVW limits were labelled BVW-A1 through BVW-A7.

Dominant vegetation within this resource area included skunk cabbage (*Symplocarpus foetidus*), sensitive fern (*Onoclea sensibilis*), and red maple (*Acer rubrum*), which are all species that thrive in wet conditions. Soils within the BVW were found to be muck. Other indicators of wetland hydrology included standing water.



Skunk cabbage



Sensitive fern

Upland vegetation near the BVW area included black locust (*Robinia pseudoacacia*) and staghorn sumac (*Rhus typhina*), which are both upland species. Based on hand cored soil samples, soils in the upland area consisted of dry, sandy soils with no evidence of mottling in the top fourteen inches.

Perennial Stream - Munroe Brook is a perennial stream that discharges at its terminus into the reservoir approximately at its northeast corner. The top of bank for both sides of Munroe Brook's northern section were flagged. The banks were natural with near vertical slope. The transition from stream to upland was almost immediate. The top of bank, which was determined using the first break in slope, was flagged in the field to show the bank of Munroe Brook. Flags left in the field included TOB-B1 through TOB-B3 along the western bank and TOB-C1 through TOB-C3 along the eastern bank. The stream segment, downgradient of the dam spillway, is also considered a natural bank. Flags left in the field included TOB-A1 through TOB-A7 along the northeastern bank of this section. This stream eventually enters the bordering vegetated wetlands area described above. Because Munroe Brook and other streams in the study area are perennial, these bank locations should be used to determine the riverfront area associated with Munroe Brook.

Land Under Water (LUW) - As mentioned above, the LUW is consistent with the reservoir itself. Water assessments of the LUW were conducted and described in detail in within the "Water Quality during Dry-Weather" and "Aquatic Habitat" sections within this assessment.

Review of Erosional Features

There are several areas along the reservoir's banks that are exhibiting erosional features. These features are most likely the cause of foot traffic or other means of access that people use throughout

the park to access the water of the Res. The features are limited in extent and occur in isolated areas, therefore they are not caused by wave action. A few, especially near hard packed areas, may also be the result of stormwater runoff into the Res, which is most prevalent near the parking lot. There are also erosional conditions present around the existing stormwater outfalls, which are in disrepair.



Condition along the northern shoreline



Condition at Rindge Park

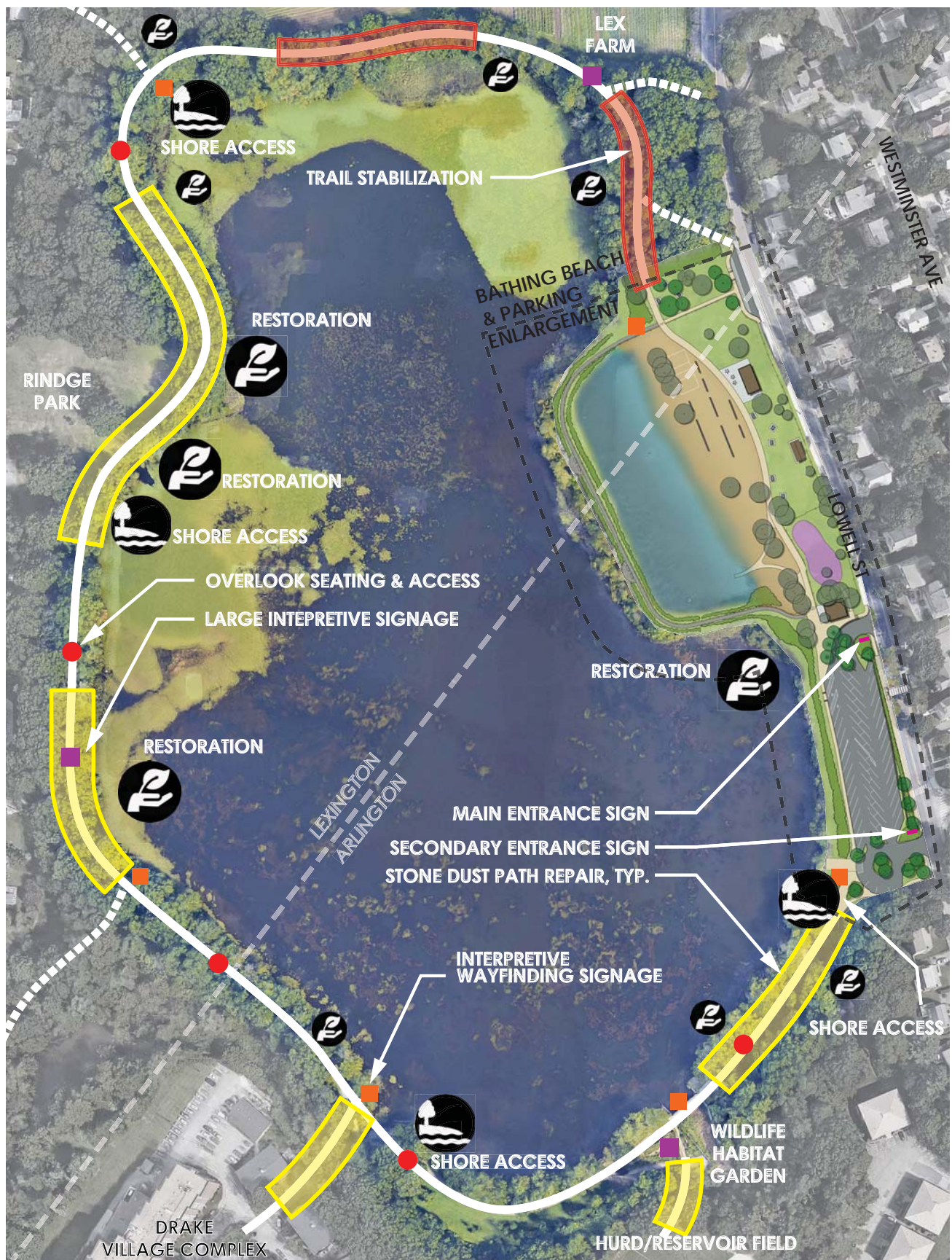


Condition along the southwestern shoreline



Condition along the southeastern shoreline

In order to avoid further disturbance/erosion of these areas proper bank stabilization, resource area protection measures, and proper stormwater controls should be implemented. This would include curbing the parking lot to prevent water from running down the banks of the Res. Careful consideration should be made as to how to prevent further erosion from occurring in these and other areas, which will be discussed in the "Preferred Master Plan" section of this report.



Overall perimeter improvement plan for The Res

PREFERRED MASTER PLAN

The master planning effort provided a unique opportunity to comprehensively assess the Arlington Reservoir for the purposes of developing a series of thoughtful and achievable enhancements. These improvements will provide benefits to all members of the surrounding neighborhood and the town as a whole. Working with the community and the Reservoir Working Group, a “Preferred” Master Plan has been developed that identifies the basic scope of desired improvements throughout The Res. In summary, the plan identifies restoration, reconstruction, reorganization or redevelopment of the entire property. The intent is to reestablish this open space gem as a focal point of community life with improved environmental conditions and recreational opportunities for both neighborhood and town-wide use. A number of goals related to the improvement of the property are described below:

- Improve the perimeter trail.
 - Establish a pilot area of the perimeter trail, shoreline erosional mitigation, and invasive species management strategies.
 - Stabilize and repair areas of the perimeter trail that are currently eroding.
 - Formalize critical linkages to important neighboring recreational resources.
 - Repair erosion control issues along the reservoir’s shoreline.
 - Remove invasive species and replant the shoreline with native species.
- Establish a pedestrian circulation strategy.
 - Identify primary and secondary entrances with nodes for services (wayfinding, seating).
 - Expand connections between park facilities, amenities, and adjacent streets and sidewalks, which include coordination with the planned traffic improvements on Lowell Street.
 - Create alternative means of travel through the beach area that completes the perimeter trail loop interior to the perimeter fencing.
 - Comply with ADA requirements to accommodate all users while balancing the rustic feel of the trail system
 - Provide strong connections to neighboring open space amenities.
- Establish a vehicular circulation strategy.
 - Identify primary and secondary entrances at the main parking lot and the boat launch entrances.
 - Create clear routes of vehicular travel within the main parking lot and boat launch driveway.
 - Identify a drop-off location for summer programming and service vehicles.
 - Identify specific Department of Public Works and maintenance vehicle access.
- Improve site permeability, visibility, and access.
 - Formalize access for recreational fishing.
 - Create overlook seating that takes advantage of the spectacular views across the water.
 - Provide clear and intuitive wayfinding into and around the property.
 - Improve the pedestrian experience along Lowell Street.
 - Comply with ADA Requirements.
- Improve water quality, filtration and pump equipment system at the bathing beach.
- Improve existing recreational facilities.
 - Improve facilities such that they will meet an increased demand that is anticipated once these improvements are implemented.
 - Improve aesthetic quality, structural integrity, interior and exterior functionality and configuration, and utility upgrades as needed within the Bathhouse and Concession Building and Pump House Building.
 - Provide flexible event space that can accommodate a range of programming.
- Improve the Wildlife Habitat Garden, including more durable fencing.

A reduced version of the plan and an enlargement of the bathing beach and parking area are contained within this section. These two drawings identify in graphic form the configuration of all proposed site features. It is important to note that the vast majority of recommendations suggest the refinement, enhancement or refurbishment of existing facilities within The Res. The plan also recommends the development of a modest level of new site amenities, that both complement existing facilities and provide new opportunities for public use and enjoyment.



Bathing beach and parking area enlargement

Neighborhood Connections

In an effort to improve pedestrian accessibility into and out of The Res property from neighboring residential streets and open space assets, the plan calls to improve path connections and signage. Specifically, these include the connections to the Drake Village Complex and Hurd/Reservoir Fields. There are many barriers in the current ground plane. These would be removed through a combination of trail stabilization, installation of rubber-based flexible pavement, and regrading to create successful and accessible pathways. The methods of improvement are described in greater detail under the Reservoir Perimeter discussion later in this section. Additionally, defining and widening the trail that runs along Rindge Park in Lexington will clearly delineate the bounds of these two distinct properties.

Wayfinding signage will also play a key role in linking The Res to nearby open space resources. A detailed discussion on the signage program is included later within this section.

Vehicular Access and Parking

This plan proposes an upgraded main parking lot paved with porous asphalt, which has the space to provide 45 to 60 striped parking spaces depending on final layout. The parking count includes three handicapped spaces, which are located closest to the arrival plaza. These spaces are aligned at a 30° angle with an 11-foot drive aisle in between each row such that the parking lot can dimensionally fit within the long and narrow strip of land between Lowell Street and the banks of the reservoir as well as meet zoning requirements. The two-way main entrance to this parking lot is proposed to be located at the renovated Check-In/Pump House Building, in a very similar orientation to where the existing entrance is currently located. A town-standard 'Arlington Reservoir' sign will mark this entrance and indicate it as the main vehicular entrance into the property. Porous asphalt will be considered for the pavement. However, vacuum sweeping maintenance requirements and frost heave potential may make this option undesirable.

A secondary driveway will connect to the main parking lot and provide four new parallel parking spaces intended for personal non-motorized watercraft drop-off only. These parking spaces will be marked for 15-minute loading; they are not intended for long-term parking. A sign at this entrance will indicate boat drop-off only, thus distinguishing this driveway from The Res's main vehicular entrance.

Through these improvements, the vehicular circulation pattern will be streamlined and clarified through striping and arrows. Vehicles can both enter and exit at the Check In/Pump House Building. When a vehicle turns into the main entrance, it will keep right and travel down a one-way row of angled parking, as shown in the vehicular circulation diagram on the following page. If all of the spots are taken, there is the option to travel through the roundabout and enter into the next one-way row of parking to look for a space. Vehicles may exit the parking lot either at the main entrance or at the boat launch entrance, since this is also a two-way driveway.



Main parking lot and boat launch vehicular circulation



Drop-off area vehicular circulation

The informal parking lot used for staff parking, deliveries and staging area for group parties located in the northeast corner of the bathing beach area will be transformed into a drop-off for buses and other vehicles to stand temporarily while dropping people off, collecting day campers, making deliveries, or dropping off materials for group parties. This small pull-off has capacity for two school bus lengths, would also be paved with porous asphalt, striped and signed to denote temporary standing only.

Boat Launch

The boat launch will be relocated to connect to this driveway and provide access directly into the water. This new, more accessible location for the boat launch is generous in size such that it will provide water access for the equipment typically used for the management of aquatic invasive plants such as water chestnut. The boat launch itself would be constructed as a poured-in-place concrete slab and the driveway would be porous asphalt. New tree and understory plantings around this driveway entry and in the circular island would be native and match the character of the existing planting found around The Res.

Lowell Street Edge

The existing sidewalk along Lowell Street will be maintained and include new curb cuts for new driveways and the drop-off areas. Separate from this effort, the Town is preparing drawings for pedestrian safety improvements between Westmoreland Avenue and West Court Terrace along Lowell Street. These plans include a new crosswalk and a solar powered pedestrian-activated flashing beacon across Lowell Street at Westmoreland Avenue. Improvements made within The Res will be coordinated with this Town project. Additionally, new black vinyl coated chain link fencing will be provided along the Lowell Street edge between the sidewalk and both the bathing beach and the main parking lot.

Bathing Beach and New Arrival Plaza

A critical component to unify and organize the active and passive recreation at the bathing beach is the implementation of a comprehensive circulation system. The proposed pathway network will link the numerous facilities and provide pedestrians clear and intuitive access to the beach from the parking lot, across the beach, and beyond around the perimeter trail. An arrival plaza is proposed to be adjacent to at the Pump House Building to clearly direct visitors to the bathing beach and amenities. Here, staff at a new check in area would greet tag-holders, collect admission fees, and welcome swimmers and campers with the rules and regulations at the beach. A post-and-beam

overhang would be affixed to the side of the existing Pump House Building to cover check-in operations. The new arrival plaza would welcome visitors with signage, landscaping, tree planting, and special pavement treatments. The look and feel of this plaza could be fairly informal in keeping with the naturalized feel of The Res property.



Precedent image of an overhang



Precedent image of an arrival plaza





PATHWAY HIERARCHY

Recommendations contained in the preferred master plan include the establishment of a formalized pathway system. Within the bathing beach, a primary 10-foot wide pathway would provide a linear north-south spine through this area and delineate the sandy beach zone from the passive lawn and picnic area. Secondary 5-foot wide pathways connect into this main spine and back to the existing sidewalk along Lowell Avenue. There are new pathway connections along the parking lot and to the entry plaza from Lowell Avenue that also tie into the perimeter path around the Reservoir. A new fully ADA-compliant pathway brings accessibility to the water; the pathway is less than 5% slope, eliminating the need for handrails.



Pedestrian circulation through the bathing beach and parking area

LEGEND

-  Primary Circulation
-  Secondary Circulation
-  Lowell Street Connection
-  Bus Stop

PERIMETER FENCING AND GATED ENTRIES

The preferred plan proposes a perimeter fence that will contain the bathing beach. It would start at the Pump House Building and run along the top of the berm on the bathing beach side such that a widened path and three to four accessible tables would sit outside the bathing beach area. The fence will continue to the proposed drop-off area, along Lowell Street and the relocated play area to tie back into the Pump House Building. Since it is a revenue-generating resource for the Town, there are two gate locations for entry and tag checking into and out of the bathing beach and one gate that secures the new play area. Additionally, a stretch of fence will run along Lowell Street at the parking lot to define that edge and direct pedestrian traffic.

BEACH TERRACING AND SAND REPLENISHMENT

Given the regular replenishment required to maintain the sand within the beach area, this preferred plan proposes a series of terraced seat walls that would hold the sand at different levels up-gradient from the water. Not only would they serve to hold sand in place, they provide valuable space for campers to gather and hold events, groups of people to socialize, and beachgoers to use for sunbathing or as a backrest while sitting on the sand. These seat walls are proposed to be constructed of cast-in-place concrete and would be between 12 inches and 18 inches high on one side and retain sand on the other side.

CONCESSION, PAVILION AND PICNIC AREA

The main pedestrian path serves as the demarcation between the sandy beach and open lawn within the bathing beach area. Surrounding the Bathhouse and Concession Building, a new concrete pad will be poured that can accommodate three to four café tables and chairs and offer accessibility to the Men's and Women's restrooms and concession stand. The concession stand is open during the bathing season, and serves snack type foods. A number of picnic tables will serve as an extension from this expanded concession area. A new pavilion, roughly sized at 15-feet wide by 30-feet long, will be located in the center of this lawn area and sit on a concrete pad. It would offer a covered seating area and be a rentable location to host small parties or group events or a venue for larger town-wide programming.



A multiuse pavilion within a park

BEACH VOLLEYBALL

A formalized beach volleyball court would be located within the beach area just north of the terraced seat walls. Existing trees will provide shade and tucks the court away from the rest of the sandy area

open to beachgoers.

Pump House Building

The recommendations below assume only minor renovations that will not trigger more substantial architectural and structural upgrades.

BUILDING ENVELOPE

As discussed earlier, the proposal would affix an overhang to the side of the Pump House Building, which would provide cover for an outside check-in area for beachgoers. The exterior facade would be improved by cleaning the CMU block walls and potential greening with trellises or evergreen planting. A refreshed look to the park buildings has potential to build identity for The Res as it attracts a wider user group.

Replacement of the roof system with a single-ply membrane and associated new drains, flashings, copings, etc. is also recommended along with cleaning and re-pointing of the exterior. The application of a water-repellent breathable sealer should also be evaluated. The steel doors and frame are showing some corrosion at their lower edges and is recommended for replacement.

INTERIOR CONSTRUCTION AND FINISHES

The preferred master plan calls for adding inside walls in order to reconfigure the interior space and separate filter equipment from other uses inside the building. All existing walls and ceiling would be repainted as part of the building renovation. Additionally, the door and frame to the storage/workroom is corroded at their bottom edges. Both are recommended for replacement.

STRUCTURAL

The structure was found generally capable of supporting anticipated gravity loads (i.e., dead, live, and snow loads) and lateral loads (i.e., wind and seismic loads). The following are recommended for only minor renovations as noted previously:

- Remove vegetation growth immediately adjacent to the building and repair concrete masonry as necessary.
- Clean exterior of concrete masonry and apply sealer to reduce moisture intrusion. Note that the sealer requires re-application every three to five years. The masonry should be dried by means of heat and/or dehumidification prior to the application of the sealer.
- Clean steel framing, including exposed surfaces of lintels, and metal deck. Coat with corrosion resistant paint system.
- Install steel supports at the edges of the roof penetration.

Bathing Beach Filter System and Water Quality

In order to improve bathing water filtration and clarity, a new filtration system is proposed and includes new piping, filter, pump(s), drive(s), and valves. The existing suction and collector tank system should be renovated to replace the collector tank and install new interconnecting piping between the filter system and bathing beach. Additionally, a new chemical feed system is required as part of this system, which includes new tanks, feeders, controller, and piping. This system introduces the use of reservoir water in lieu of domestic water to supplement the bathing beach. In order to do this, an influent water line from the reservoir side of the bathing beach will be installed

with a pump to bring free water into the system. A new inlet delivery system is needed to reduce the velocity of water injected into the bathing beach.



Example of a new sand and filter system

This new system will also introduce UV treatment, which helps with disinfection and reduces the amount of chlorine used. Finally, a new skimming system will be installed in order to clean the water before it circulates into the swimming area.

Bathroom & Concession Building

The recommendations below assume only minor renovations that will not trigger more substantial architectural and structural upgrades.

BUILDING ENVELOPE

Replacement of all roof trim is recommended, which would include new skylights, roof trim, gutters, downspouts and gable louvers. Alternate materials such as cellular PVC or fiber-cement board should be considered as more durable options. Cleaning and re-pointing of the exterior is recommended, and the optional application of a water-repellent breathable sealer should be evaluated. All exterior doors, frames, entry screens and associated hardware should be replaced. Further investigation and the possible reconstruction/replacement of these interior walls is recommended.

As well, the coiling shutter requires replacement at the concession window. New exterior lighting and outdoor shower upgrades should also be included. In a similar fashion to approach with the Pump House Building, this facade should be improved by cleaning up the CMU block walls and greening the walls in some way, such as with vines growing up trellises or evergreen planting in front.

INTERIOR CONSTRUCTION AND FINISHES

Hinged access panels in the chase walls are corroded and are recommended for replacement. The use of solid-plastic toilet partitions and screens is recommended. New doors and frames would be installed as part of this improvement plan. The water closets, urinals, lavatories, toilet partitions and screens, and toilet accessories would also be upgraded. Replacement of all lighting fixtures with new LED-type fixtures is recommended as well as a new domestic water heater and gas service or electrical upgrades. Finally, the plan calls for adding inside walls in order to reconfigure the interior

space and capture a larger area for concession.

The long term vision for concessions is to offer simple snacks only, that can be supported by a refrigerator, freezer, sink and microwave.

ACCESSIBILITY

Given that a minimum 30-inches wide portion of the concession window must offer a counter height of 34-inches for ADA compliance, the reconfiguration of the service window is required.

STRUCTURAL

The Bathhouse and Concession Building was found generally capable of supporting anticipated gravity loads (i.e., dead, live, and snow loads) and lateral loads (i.e., wind and seismic loads) with reinforcing noted below. The following are recommended for only minor renovations:

- Repair/replace existing roof sheathing. Provide additional fasteners from existing sheathing to remain to roof rafters for resisting lateral loads and wind uplift.
- Reinforce existing roof rafters by adding new rafters adjacent to the existing rafters (i.e., "sistering"). Provide ties across the width of the building at each rafter to resist horizontal thrust.
- Repair/replace existing wood top plate.
- Provide uplift ties from rafter to top plate. Anchor the top plate to the concrete masonry wall. Provide continuous load path to the foundation.
- Investigate exterior screen walls for vertical reinforcing. Unreinforced cantilevered masonry walls pose a potential hazard and should be removed and rebuilt.

Children's Play Area

The preferred master plan relocates the play area closer to the arrival plaza for a few strategic reasons. First, relocating the playground out of the beach area allows it to be accessed all year round, even during the bathing beach season. Secondly, the playground would be located closer to the parking lot and thus more easily accessible to families, caregivers and small children who are the most likely users of this space. Finally, this new location features the playground visually accessible from Lowell Street, which will make for an inviting view into the property especially it is filled with happy kids running around and playing on new state-of-the-art play structures. This particular location also traverses roughly four feet of grade change, which could be incorporated into the final design and provide a unique play experience for those who come to enjoy the playground. There would be only one gated entry and a perimeter fence would enclose this space. The community expressed an interest in using a more ornamental fence in strategic locations around The Res; the playground could be one of these locations.

Reservoir Perimeter

EROSION AND PROTECTION OF ENVIRONMENTAL RESOURCE AREAS

In order to prevent further erosion along reservoir's banks and to protect the environmental resource areas, improvements to the reservoir perimeter would include the following, as graphically depicted on the Overall Reservoir Improvement Plan:

- Stabilizing sections of the trail
- Repairing sections of stone dust as needed
- Incorporating seating and fishing access at opportune locations
- Installing buffer plantings to prevent off-path access

- Installing educational signage

Trail stabilization efforts will include establishing a typical 6-foot trail width, installing Rubber-based flexible pavement or similar pathway material in selected areas, and directing runoff away from the reservoir. Rubber-based flexible pavement will be implemented strategically in areas that are particularly difficult to traverse due to protruding tree roots and other barriers within the pathway. Rubber-based flexible pavement is very porous, made from recycled material, and has the ability to clean water as it passes through. Rubber-based flexible pavement is slip-resistant and resistant to freeze-thaw due to its flexible nature, so it is extremely durable and can withstand heavy trail use.



Example of rubber-based flexible pavement installation on a trail

Plantings of appropriate species along the reservoir's edge of any pathway would begin to discourage visitors from accessing sensitive areas such as Bordering Vegetated Wetland (BVW) or recently restored banks. Several different plant species could be used; however, they should be selected based on native plantings found on site as well as tolerance for inundation and seasonal drawdown. The plants should also exhibit the following characteristics:

- Generally, woody species perform the best for this purpose. They are difficult to navigate and push aside and provide ample resistance when people try to walk around them.
- Species should be tightly grouped together as to not allow for gaps between individual plants.
- Species should be low in height to avoid obscuring the view across the water. Ideally, shrubs should grow to waist height at full maturity.

By providing designated seating overlooks and fishing spots along the pathway, people may no longer feel the need to create their own access and disturb wetlands and restored areas. These overlooks will consist of one or two new benches set in either stone dust surfacing or on a concrete pad. Their proposed locations are based on particularly spectacular views or opportune fishing locations. Minor tree pruning and understory shrub cleanup will be required to preserve views.

The final piece to protecting the shoreline is education. By educating the public that some of these newly established stabilization and/or habitat areas are sensitive and fragile, most people will choose to protect rather than disturb them. Interpretive signage, as described in the following pages, could be used as a communication tool to achieve this end.

WILDLIFE HABITAT GARDEN

The Wildlife Habitat Garden would be preserved in its current form and protected within a new, durable perimeter fence. The fencing should be fairly minimal in look with the purpose to discourage foot traffic while allowing for wildlife passage. The pathways around the gardens also need to be regraded and stabilized in order to provide accessibility.

SIGNAGE AND WAYFINDING

A well designed signage program, throughout the bathing beach area and along The Res's perimeter trail, could provide stopping points to read about the environment and wayfinding to nearby open space resources. The master plan includes an allocation for three large 24-inch by 36-inch vertical or angled signs and six smaller 8-inch by 10-inch signs of a similar aesthetic. All of these signs would be affixed to power-coated aluminum posts; the signs themselves are graffiti-resistant.

The larger signs are envisioned as interpretive, or educational, in nature and have been located on the Overall Perimeter Improvement Plan contained earlier in this section. These signs could identify environmental resource areas, as well as educate the public on the restoration process of the banks, removal of invasive species and any other important projects within the entire property. There is also an opportunity to use these signs as means to describe The Res's rich history as a cultural and social resource.



Example of large interpretive signage



Example of small wayfinding signage

The smaller signs would be deployed as wayfinding signs that orient visitors to their location within The Res property itself as well as indicate connections to other nearby open space resources, such as Arlington's Great Meadows, Whipple Hill, McClennen Park, Mount Gilboa Conservation Area, Cataldo Reservation, Minuteman Bikeway.

Environmental Recommendations

The following recommendations include methods to stabilize bank erosion, to control aquatic nuisance and invasive plants and to manage terrestrial invasive plants along the reservoir's shoreline.

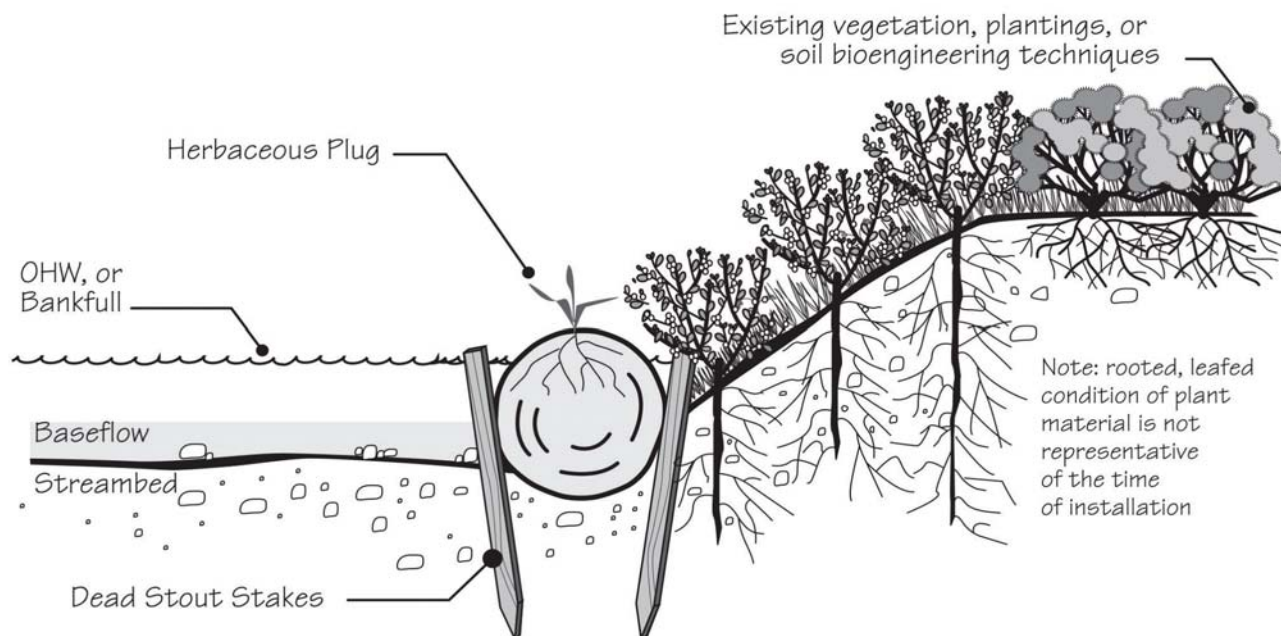
BIO-STABILIZATION OF BANK EROSION

As noted in the Environmental Assessment section, there are several areas along the reservoir's banks that are exhibiting erosion. This master plan carefully considers how to prevent further erosion from occurring in these and other areas while maintaining shoreline access for fishing. As just discussed, enhancing and improving the pathways along the shoreline will also reduce erosion along the shoreline by keeping pedestrians on stable materials.

If erosion is minor and due to foot traffic, only a limited protection measure may be necessary.

However, if the location is subject to heavy wave and wind action, a stronger intervention may be necessary. The proper protection measures should be evaluated on a case-by-case basis, tailored to the specific area of concern and the particular erosional forces at work in that location. The annual drawdown regimen should also be considered when determining the proper protection measures.

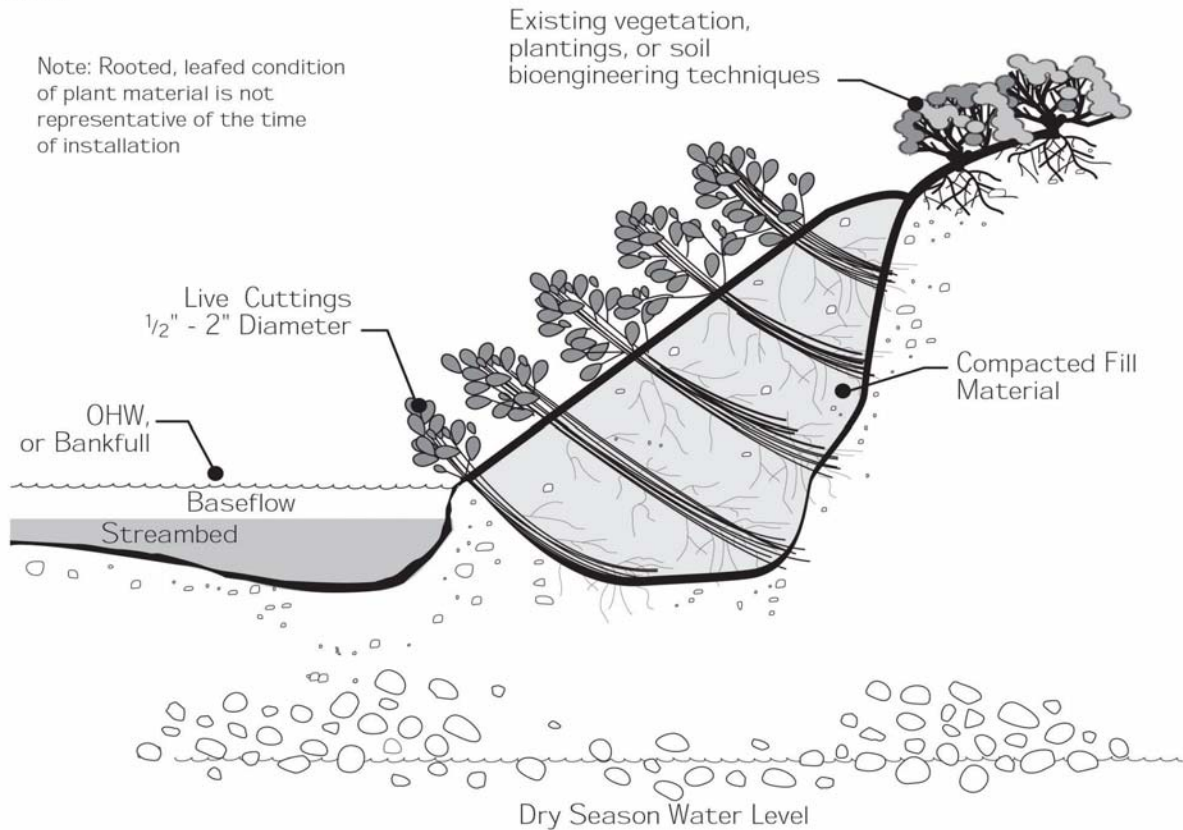
Bio-stabilization practices have been developed and will be installed in accordance with "A Soil Bio-engineering Guide for Streambank and Lakeshore Stabilization," a U.S. Department of Agriculture Forest Services guide. The techniques proposed below were selected not only to provide protection of the shoreline but to also mimic and create a natural riparian environment and provide habitat for riparian and pond species, including fish that currently or could make a home at The Res.



Coconut Fiber Roll

Coconut Fiber Roll - Offering a moderate level of protection the coconut fiber roll (or coir fascine) would be installed parallel with any eroded bank. The roll would be installed with hand driven wooden stakes. Plantings would be placed directly behind and on top of the roll to help restore and stabilize the shoreline. The roll would be placed so that it is not overtopped during times of high water in the reservoir. Multiple rolls would be stacked to achieve the appropriate height. The benefit of this application is that the coconut fiber is a natural material that will eventually decompose and become part of the natural bank. As the vegetation planted behind and within the coconut fiber roll become established, this area will become indistinguishable from its surrounding bank.

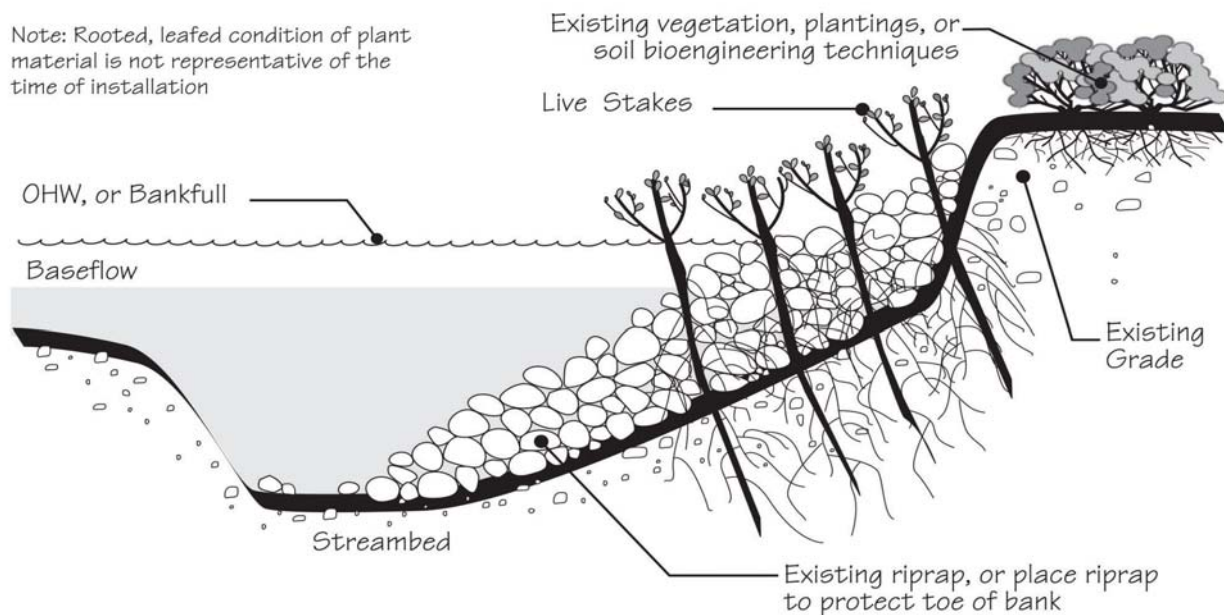
Brush Layering - Utilized in areas of large cavities along the banks, brush layering allows for the ability to jump start the bank regrowth process. Layering live cuttings within horizontal layers along any bank fill will promote both regrowth and bank stabilization. The branches serve as tensile inclusions or reinforcing units to keep the soil in place. Over time, the branches will sprout and establish a root system throughout the fill area. This technique is best used in areas above the ordinary high-water mark; it can be combined with other stabilization techniques, such as the coconut fiber roll, at the water line.



Brush Layering

Joint Plantings - In areas where hard engineering solutions are a "must" due to heavy erosional forces, there are still methods to bioengineer those hard solutions. If the solution is to stabilize a slope with rip rap, joint planting is one of those methods that in which live stakes can be planted in the stone bank. As the live stakes grow they create habitat and help disguise rip rap slopes. Additionally, as they root into the embankment, they also help to stabilize the slope.

Although these are some of the bio-stabilization techniques that could be used at The Res, there are a number of other methods that could also be implemented. A site-by-site evaluation would be required in order to understand what is causing that area's particular erosion and the best methods to not only correct the issue, but to prevent further erosion from occurring. Part of that prevention would be accomplished through proper environmental and pathway design as discussed previously.



Joint Planting

NUISANCE AND INVASIVE AQUATIC PLANT CONTROL

A primary obstacle to its continued capacity to support valuable ecological and recreational function is an overabundance of aquatic plants, dominated by invasive species. Plants cover at least 90% of the reservoir's bottom and fill close to 75% of the water column. Water chestnut covers much of the surface of the reservoir and cloudy water impedes water-bird and aquatic-life feeding, fishing, and looks unappealing. Based on available data, the turbidity appears to arise from resuspension of organic sediment and, while algae do not appear to be a major issue at this time, better control of macrophytes (e.g., water chestnut) could allow algae to proliferate.

Appropriate goals for the reservoir should include the following:

- No more than 20% surface cover by plants
- No more than 50% of the water column filled with plants
- Turbidity <5 NTU for 95% of the time

Reducing plant abundance, particularly invasive species, is the primary focus of this management review. Key considerations for determining the most appropriate approach include cost, technical feasibility, regulatory permissibility, and Town and community acceptance. Four reasonably feasible options for aquatic plant control at The Res are discussed in detail, below:

Draining and Dredging - Draining and dredging The Res would reset the entire system, and could be highly beneficial for many years. However, the permitting process and cost are often untenable. While no study of material quantity and quality has been conducted, it is reasonable to assume that at least half a foot of soft sediment could be removed from at least 20 acres of reservoir area, or 10 acre-feet, which is roughly 16,000 cubic yards. Costs could range from \$500,000 to several million depending on the type of material encountered, especially if the sediment is contaminated to a degree that requires special disposal methods. Nearly all urban and suburban lakes in Massachusetts have contamination by metals and hydrocarbons that require controlled disposal, which can raise the cost at least threefold. In order to support this kind of dredging project, additional testing and evaluation would be necessary than what is provided in this assessment. Such a method would represent

true restoration of the reservoir to original conditions when the dam was built, and is analogous to rehabilitating a historic building. The cost is likely to be extreme for this approach.

Partial Drawdown - Partial drawdown is currently practiced annually and involves dropping the water level of the reservoir by about two feet. In the past, the reservoir elevation has been lowered soon after the last official day of swimming at the bathing beach or when practical with respect to heavy rain events, which is sometime in September. The lowest elevation obtained is near 153.0. It should be noted this start time is earlier than recommended for Massachusetts lakes under DEP guidance and it is recommended that the Town consider whether an adjusted drawdown schedule would be appropriate. Drawdown appears to help to flush the reservoir. An approximate 50% decrease in volume would result of a two-foot drawdown from the normal water level. Partial drawdown helps to maintain coarser substrate around the edge; however, only a small portion of the bottom is actually exposed by partial drawdown. A three-acre reduction in area results from a two-foot drawdown. Drawdown has almost no cost and does provide benefits, but the current practice is inadequate to fully control plants throughout the reservoir. Full drawdown is alternative approach that is used at some ponds. Full drawdown would drain the entire reservoir and would kill the invasive plants, but it would also kill the native plants and adversely affect water-dependent wildlife. We also understand that existing reservoir controls do not allow for full drawdown. Given the likelihood of adverse effects and current water-level control infrastructure, we do not recommend further consideration full drawdown at this time.

Mechanical Harvesting - Mechanical harvesting is also currently practiced. In 2017, it was conducted in September long after seeds from water chestnut and any other seed-producing plants were generated and dropped. Plant biomass was removed, but no carry-over benefits would be expected in 2018 because harvesting happened too late in the year. The focus of mechanical harvesting in the past appears to be on water chestnut, which is entirely appropriate. If the Town is paying for such services, the harvesting should be completed in early July in order to reduce seed production, which could potentially lead to a long-term decline in water chestnut abundance. Effective harvesting is usually a twice-per-year operation, with one cut in late spring and one in summer. With water chestnut as a dominant species, it is best to let the plant grow to the point where surface leaves have formed, but not to the point where seeds have been produced, which is usually in July. A single cut in June might be enough, but other species such as milfoil and coontail may grow to nuisance proportions after a June harvesting event. At an expected cost of \$1,500 per acre per cut for dense growths, about 20 acres could be harvested for \$30,000 on a contract basis. Less area was harvested in 2017 and it may not be necessary to harvest 20 acres to meet all use goals; more intensive and timely harvesting is needed if plant control is to be achieved. At least 10 acres of harvesting is needed twice per year. Other plants in the reservoir could be harvested as well, but the density of coontail and milfoil in the southern portion of the reservoir did not suggest much harvesting was performed there in 2017. In the future, there is ample room to lay out and dry removed plant material along the trail pathway just south of the boat launch. For roughly 100 feet, the pathway is quite generous at 12 to 15 feet wide. If needed, it can be reduced to just 5 feet wide temporarily if needed.

Benthic Barriers and Herbicides - While we do not know the complete management history of The Res, benthic barriers and herbicide techniques do not appear to ever been done. Benthic barriers are not typically deployed over many acres of any given waterbody but could be used to establish lanes for boating or fishing. Non-porous barriers can suppress plant growths for a year or more with no maintenance, but eventually soft sediment accumulates on them and allows growth. It is usually recommended that barriers be removed and cleaned once per year. Fishing lures tend to snag on the benthic barrier; however, there are few other interfering factors.

The cost for these materials is least \$30,000 per acre. Sheets are just over 10 feet wide, however, and can be laid end to end to create lanes where plant growth is suppressed. For about \$100,000,

it is possible to create a series of runways that will increase edge effect and maximize habitat. This initial investment would return benefits for about ten years. Additional labor costs apply, but the material itself would not have to be replaced for about a decade, making the annual cost much lower when spread over the life of the material. Assuming \$10,000 per year in labor, the annual cost would be about \$20,000 on a 10-year basis.

TERRESTRIAL INVASIVE PLANT MANAGEMENT

Below is a detailed description of the recommendation for invasive species management and monitoring as it applies to the subject site. As stated in the Environmental Assessment section, several different types of invasive species were noted in the study area. These include:

- Garlic mustard (*Alliaria petiolata*)
- Japanese barberry (*Berberis thunbergii*)
- Asian bittersweet (*Celastrus orbiculatus*)
- Winged euonymus (*Euonymus alatus*)
- Glossy buckthorn (*Frangula alnus*)
- Morrows honeysuckle (*Lonicera morrowii*)
- Purple loosestrife (*Lythrum salicaria*)
- Japanese knotweed (*Polygonum cuspidatum*)
- Multiflora rose (*Rosa multiflora*)

Invasive Species Management - As part of improvements to The Res, these invasive species within the work area would be managed and removed. Replanting of these areas with native species is recommended. Out of the species noted above, it is recommended that the most aggressive invasive plants are prioritized. Residents have reported that Asian bittersweet, in particular, has caused severe tree damage and could be the first candidate for removal. However, more observation is necessary to determine which areas around The Res should be of initial focus. There are a number of different applications available for the management and removal of invasive species, which are broken down into the following three categories: mechanical, chemical, and biological.

Each category has its own advantages and disadvantages and each can be applied in specific cases where other methods may not be as applicable. Mechanical methods include any type of physical removal of the plant biomass, including pulling, mowing/cutting, digging and burning. Chemical treatments include the application of herbicides. This technique is often used in conjunction with mechanical removal. For instance, cut and dabbing is the process of cutting invasive species to ground level and then dabbing the stems with an herbicide. Biological control utilizes pest or insects as predators for target species and is much rarer. For The Res, we only recommend the mechanical and chemical methods due to the complexities involved with funding and managing biological treatments.

Mechanical Methods - Mechanical methods are usually the first approach to handle most invasive species because they require no special licensing or handling of chemicals. Most of the work can be done with little to no permitting and with the assistance of either volunteers or a hired landscape crew. However, mechanical removal methods require a long-term commitment and will require continued maintenance of the invasive species zones to ensure that they do not grow back. Depending on the breadth and extent of the population, mechanical methods may also require large areas of disturbance, especially when digging is required. Disturbed areas can become prime breeding grounds for re-growth or encroachment of other invasive species. Two types of methods that have proven effective are highlighted below:

- Pull or Dig: Large herbaceous and woody plant species can often be pulled out and have their roots dug up, if found in limited quantities. When utilizing this method, it is important to remove

as much of the plant material as possible including root mass, stolons, and rhizomes. Some species can re-infest an area if as little as a small root is left behind (i.e., Japanese knotweed). Instead of using a shovel, digging with a fork or similar tool may be preferred. Shovels can often cut through a root, leaving a portion behind, whereas a fork will tend to pull the entire root system. In some instances where large stands are present, it may be beneficial to work with a small excavator or bobcat to remove large portions of infested soil. This work could be completed in the early spring where seeds have yet to mature and the soil is still moist. The moist soils will allow for easier pulling of most species and, if the seeds are yet to mature, it will reduce the risk of seed transport to other areas.

- **Light Barriers:** The introduction of light barriers is a method used to remove small seedlings and other small herbaceous plants that can not readily be pulled. This method involves the placement of any light blocking material (usually plastic sheeting or weed block) over the infestation. It should be staked or weighed down and extend outside of the infestation area. Light barriers can either be left in place or loamed and seeded over. This technique will kill all species, both invasive and native, that are trapped under the barrier.

Chemical Methods (i.e.; Herbicides) - Herbicides are one of the most effective ways to treat invasive species, however, careful consideration should be taken when using any chemicals, especially when adjacent to a resource area such as in this case. Chemical methods are usually applied in two ways: large scale spraying (often seen on power line easements) and small scale localized applications.

Due to the location of the invasive species, large scale spraying is not recommended for this project. Instead, localized applications would be more effective, if chemical treatment is at all preferred. Localized applications would be conducted alongside a mechanical method such as cutting. With chemical treatments, it is important to interrupt the life cycle of the species, and therefore timing is paramount to any successful chemical treatment. Two chemical treatment methods that have proven effective are highlighted below:

- **Small-scale Spray Applications:** Utilizing a backpack sprayer or equivalent, such as a small handheld sprayer, chemical treatments of monocultures or individual invasive plants can be conducted. Spray applications have proven useful against herbaceous species, such as purple loosestrife, that are often tough to manage with mechanical methods. It is also a practical alternative for some woody species, such as Japanese barberry, Japanese honeysuckle, and Asian bittersweet, that grow in dense stands. It is generally recommended that the mixture contain no more than 5% of the active ingredient and that treatment occur in early spring when the plants are growing. This will break up their life cycle and stop future growth. It is also recommended that spraying take place when no rain is forecast for several days afterward to ensure that the treatment does not wash away.
- **Cut and Dab:** The cut and dab method essentially combines a mechanical and chemical treatment together. The goal is to avoid large ground disturbance caused by digging up roots and to instead apply a chemical treatment to a cut stems or roots. These treatments require a higher concentration of the active ingredient than is used in small scale spray applications. A 25-35% solution of the active ingredient should be used. Stems would be cut as close to the ground as possible and herbicide would be applied directly to the cut surface. This application would be completed as soon as possible after the plant is cut to ensure effectiveness of the herbicide. The herbicide can be applied in many different methods including spray bottle, rag, brush, or sponge. The cut surface must be thoroughly wet such that the herbicide gets into the plant. This technique is most effective in late summer or early fall.

Drainage and Stormwater Systems

The logistics of the property's overall drainage, stormwater management, and other utility systems will need to be engineered to accommodate the new main parking lot and drop-off area, new hardscaped areas such as the arrival plaza, and recreation assets both inside and outside the bathing beach area. It may be necessary for these systems to be modified in order to best fit the site's environment while accommodating optimum drainage patterns and water quality improvement into the reservoir itself. Green infrastructure techniques such as bioretention areas, tree infiltration trenches, and bioswales should be considered as viable options for infiltration. Additionally, all existing drains and outfalls and their relationship to water quality should be thoroughly evaluated as the improvement plans are refined and replaced as necessary.

Vegetation

It is anticipated that a more proactive vegetation management program will yield very positive environmental results as well as recreational and aesthetic benefits. The removal and management of both terrestrial and aquatic invasives has been discussed above. In order to improve visibility and safety, this master plan recommends selective pruning of the mature tree canopy. Pruning around the perimeter path will maintain and enhance existing views and overlook areas and prolong the life of the existing trees.

Tree planting within the bathing beach area will add more shade and opportunities for picnicking within the passive recreation zone. A row of street trees along the Lowell Street sidewalk will establish an inviting aesthetic character and indicate to passersby that The Res is a recreational resource. A greener street edge will also be more hospitable to pedestrians travelling along the stretch of Lowell Street. Tree planting within the arrival plaza would soften the hardscape and provide respite for those gathering in that area. Additional tree and shrub plantings are scattered throughout the bathing beach and parking areas and will enhance the park-like feel of The Res.

Overall Landscape Aesthetics and Environmental Enhancements

There is general agreement that improvement to The Res will be an attractive source of pride to the surrounding neighborhood. To this end, a series of landscape improvements have been identified that will help enhance the property as a beautiful and aesthetically satisfying open space resource envisioned by all master planning participants.

- Improve vehicular circulation and provide specialized areas for drop-off and boat launching.
- Develop attractive edge treatments along Lowell Avenue and alongside adjacent open space resources, specifically Rindge Park that includes wayfinding signage and information, tree plantings, trail improvements and related landscaping.
- Improve visibility and safety through the management of vegetation throughout the property. This includes selectively pruning desirable vegetation, and the removal of dead, diseased or invasive plant species.
- Plant more vegetation, specifically trees that are nut-bearing or provide fruit for wildlife. Consider a management plan for long-term tree viability.
- Provide attractive new recreational assets within the bathing beach, such as a new pavilion, that bring new users to the property and make The Res a regional destination.
- Refurbish all of the existing facilities such that they contribute to the functionality and aesthetic character of The Res property.
- Renovate and install new filter and pump equipment such that water quality within the bathing

beach improves and The Res becomes a healthy and active recreational resource.

- Install furnishings and amenities that include benches, picnic tables, trash receptacles, bike racks and the like.
- Install interpretive signage that presents the unique historical, environmental, recreational and cultural assets of The Res.
- Stabilize difficult terrain and regrade sections of pathway that are under-performing, difficult to navigate, or inaccessible. Cut back overgrown vegetation and standardize the path width.
- Remove and manage aquatic and terrestrial invasives.
- Stabilize erosional issues along the shoreline and replant these area with native species.
- Tailor site drainage and stormwater management system to accommodate new site amenities and enhance existing environmental systems.
- Repair and/or replace drainage structures and outfalls as necessary.

MASTER PLAN IMPLEMENTATION STRATEGY & BUDGET CONSIDERATIONS

Budget Summary

The following budget outline identifies basic work efforts related to the potential refurbishment of The Res. Cost could vary considerably based on the manner in which the improvements are grouped, the time it takes to implement the full extent of improvements, and the material selections of the actual improvements. As with the plans themselves, these estimates are conceptual in nature and will require confirmation and refinement as actual improvements are contemplated.

Table 13. Budget Summary	
Phase I	\$991,000
Phase II	\$3,687,000
Grand Total	\$4,678,000

Phasing

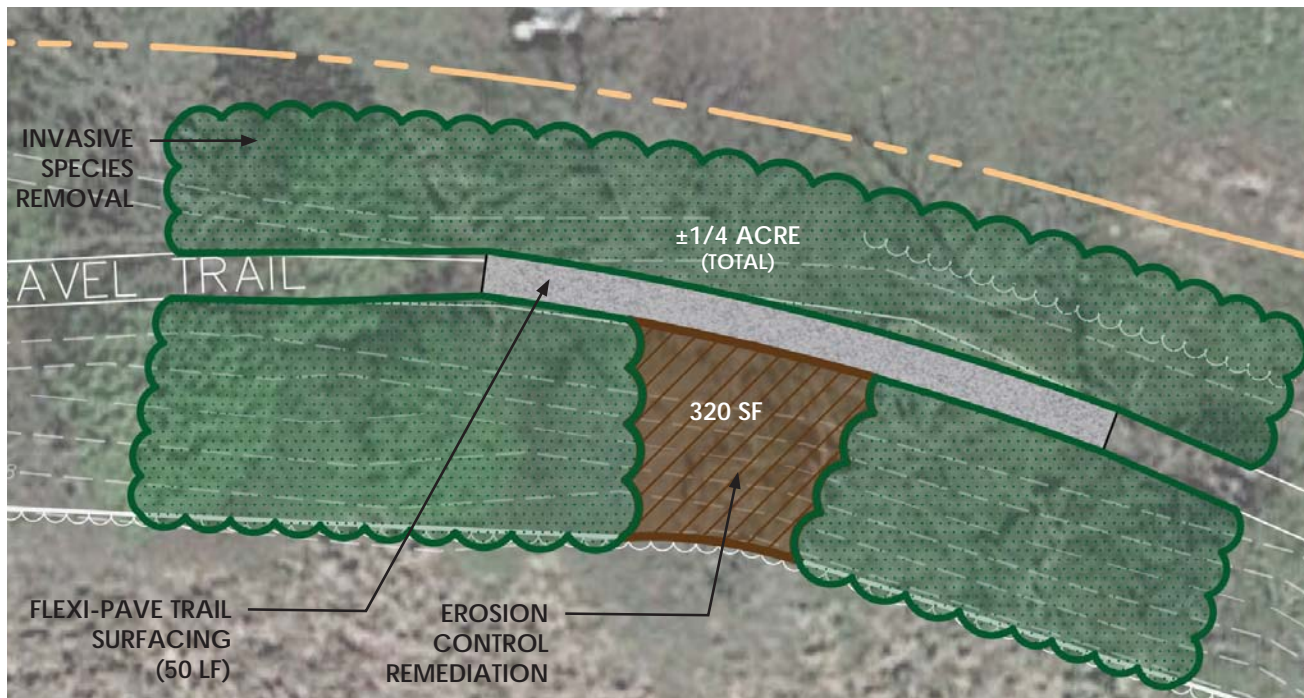
A potential improvement phasing program has been identified and is based on the specific needs and preferences expressed at public hearings and through discussions with the Town and the Reservoir Working Group. The plan below depicts the specific areas included within the Phase I scope of improvements in yellow.



Phase I improvement areas

PHASE I PROGRAM

Given that the mechanical equipment and Pump House Building were found to need immediate repair and/or replacement to ensure the continued operation of the bathing beach, these facilities have been identified as a critical need and is the focus of the Phase I improvements. Additionally, the first phase will focus on a pilot area of the trail and reservoir perimeter, which is graphically depicted below and indicated as the northernmost rectangle on the previous page's diagram. Improvements consist of repairing erosion control issues, removing invasive plant species, adding native species as needed, laying new permeable and accessible trail surfacing, ensuring positive drainage, and protection of existing roots.



Pilot area identified as part of the phase I improvement program

With the bathing beach both as a beloved recreational and revenue-generating resource for the town, Phase I improvements would occur in between bathing beach seasons. Construction would begin at the close of one bathing beach season and would finish at the start of the next season. Table 14 below summarizes the items included under the Phase I program. A more detailed breakdown of budget considerations is included as Appendix M.

Table 14. Phase I Program	
Demolition and Site Preparation	\$20,000
Piloting of Trail and Reservoir Perimeter Improvements	\$20,000
Pump Equipment Repair/Replacement	\$495,000
Pump House Building Repairs	\$138,600
Construction Subtotal	\$673,600
Construction Contingency (10%)	\$134,720
Contractor Mobilization, Overhead and Profit (15%)	\$101,040

Soft Costs (12%), including design, engineering and permitting	\$80,832
Phase I Total	\$990,192
Phase I Total SAY:	\$991,000

PHASE II PROGRAM

Phase II improvements will complete the remainder of trail and reservoir perimeter improvements. Any adjustments to the pilot stabilization strategy would be adjusted based on the successfulness of Phase I. Renovations are planned for the Bathhouse and Concession Building, the main parking facility, perimeter fencing, and gates. A boat launch and interpretive and wayfinding signage are also planned. Additionally, improvements to the infrastructure at the bathing beach include dredging of sediment within the swimming area, removal of invasive vegetation along the embankment, reinforcing the embankment, constructing a weir and armoring the interior embankment walls such that the mechanical system installed in Phase I provides the optimal swimming experience for beachgoers. Specific to the bathing beach, Phase II improvements include a new drop-off area in place of the existing staff parking lot, a formalized entry plaza at the Pump House Building, a new picnic area, a new and relocated children's playground, pathway improvements, seating and fishing overlooks along the earthen berm, a beach volleyball court, replenishment of the beach sand and terraced seating that mitigates sand migration into the swimming area, a pavilion that serves as a multi-use space, new tree and shrub planting and pruning of existing trees. Improvements are planned to improve accessibility around the entire property. Table 15 below summarizes the items included under the Phase II program. A more detailed breakdown of budget considerations is included as Appendix M.

Table 15. Phase II Program	
Demolition and Site Preparation	\$82,000
Remaining Trail and Reservoir Perimeter Improvements	\$252,000
Bathhouse and Concession Building Renovations	\$370,300
Parking Lot, Fence and Gates	\$579,600
Boat Launch	\$9,400
Bathing Beach Infrastructure Improvements (including sediment cleanout)	\$350,000
Interpretive Signage	\$3,000
Additional Renovation Considerations	
Drop-off Area	\$29,100
Entry Plaza	\$38,500
New Picnic Area at the Concession Building	\$60,400
Playground	\$225,000
Pathway Improvements	\$173,200
Overlook Seating	\$13,500
Beach Volleyball	\$2,000
Beach Sand Replenishment	\$32,000

Pavilion	\$87,400
Terraced Seating	\$79,800
New Tree and Shrub Planting	\$100,800
Pruning of Existing Trees	\$20,000
Construction Subtotal	\$2,508,000
Construction Contingency (10%)	\$250,800
Contractor Mobilization, Overhead and Profit (15%)	\$376,200
Soft Costs (12%), including design, engineering and permitting	\$300,960
Phase II Total	\$3,686,760 (should be 3,435,960)
Phase II Total SAY:	\$3,687,000 (should be 3,436,000)
TOTAL PROJECT COST	\$4,678,000

Funding Opportunities

Funding for Phase I was recommended by the Town's Community Preservation Committee and Town Meeting approved that request. Funding beyond that included in the Recreation Department's annual capital budget may be necessary to complete the work outlined in Phase II. There are a number of funding opportunities available for the Town's pursuit and are listed in the table below and on the following page. When awarded, grants typically include a date by which they must be used, which should be considered when making an application. A number of these grants also require a local financial match and/or require that the grant be paid via reimbursement, which means that the Town must have the funds in place at the project's onset in order to be paid in full, as outlined below.

Table 16. Funding Source					
Massachusetts Executive Office of Energy and Environmental Affairs					
Grant Name	Eligibility (specific to The Res)	Maximum Award	Matching Requirements	Application Deadline	Expected Pay
Parkland Acquisition and Renovations for Communities (PARC)	Improvements to existing parks	\$400,000	Reimbursement program	Mid July	
Massachusetts Land and Water Conservation Fund	Development and renovation of parks, recreation and conservation areas	unmin. \$10,000; max \$200,000	Reimbursement program	Early June	

Landscape Partnership Program	To build a park or playground	\$1,250,000	Up to 50% of total eligible project costs; reimbursement program	Late Fall	
Massachusetts Department of Environmental Protection					
Grant Name	Eligibility (specific to The Res)	Maximum Award	Matching Requirements	Application Deadline	
604b Water Quality Management Planning	Green infrastructure projects that manage wet weather to maintain or restore natural hydrology.	\$50,000	Reimbursement program.	Early March	
State Revolving Loan Fund: Clean Water Fund	Upgrades of existing facilities, infiltration/ inflow correction, and nonpoint source pollution abatement.	n/a	n/a	Mid October	
Massachusetts Department of Conservation and Recreation					
Grant Name	Eligibility (specific to The Res)	Maximum Award	Matching Requirements	Application Deadline	
Greenways and Trails Program/ Recreational Trails Program	Maintenance and restoration of existing recreational trails; development and rehabilitation of recreational trailside and trailhead facilities	\$5,000 to \$50,000; \$100,000 for larger projects	Must be at least 20% of the total project value.	mid Feb	
Recreational Trails Program - Education Grants	Training on trail accessibility and sustainability; Training that promotes safety or environmental protection related to recreational trails. Partnering with youth organizations, corps or individual volunteers are highly encouraged!	\$8,000 to \$10,000	Must be at least 20% of the total project value.	Rolling	
Army Corp of Engineers (ACOE) Continuing Authorities Program*					

Grant Name	Eligibility (specific to The Res)	Maximum Award	Matching Requirements	Application Deadline	
Emergency Streambank and Shoreline Protection	Construction of emergency shoreline and streambank protection works to protect public facilities	65% Federal; up to \$5m in Fed. cost	35% non-Federal.	Rolling	
Hurricane and Storm Damage Reduction Projects	The study, design, and construction of small coastal storm damage reduction projects.	65% Federal; up to \$10m in Fed. cost	35% non-Federal.	Rolling	
Small Navigation Project Study	To improve navigation including dredging of channels, anchorage areas, and turning basins.	up to \$10m	10% up-front non-Federal during construction and 10 percent over a 30-year period;	Rolling	
Aquatic Ecosystem Restoration Projects	The planning, design and building of projects to restore aquatic ecosystems for fish and wildlife.	65% Federal; up to \$10m in Fed. cost	35% non-Federal.	Rolling	
* ACOE completes the design and construction; feasibility studies can also be conducted by ACOE and ACOE will cover up to \$100,000 of the study cost. Costs over \$100,000 are shared 50/50 with the non-Federal sponsor					
Others					
Grant Name	Eligibility (specific to The Res)	Maximum Award	Matching Requirements	Application Deadline	
MA Department of Fish and Game Division of Ecological Restoration Priority Projects	Projects based on ecological and community benefits and local leadership	Small grants; PM and technical support	Not required, but will be considered in the application.	Late May	
FishAmerica Foundation Grants	To enhance fish populations, restore fishery habitats, improve water quality and advance fishery research.	Contact	Contact	Contact	

Toyota USA Foundation Grants Program	<ul style="list-style-type: none"> • Significance of need • Potential for long-term success/sustainability • Resourcefulness • Scale of project within the community or geographic region • Innovation and creativity • Ability to measure results • Cost-effectiveness • Diversity, inclusion and financial soundness 	\$50,000 minimum		March - Aug	
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Some grants included within the list above are suited for particular elements within the Phase II program. For example, the three Executive Office of Energy and Environmental Affairs grants can all be used to fund improvements to the bathing beach facilities, arrival plaza and main parking lot. Trail improvements can be supported through Massachusetts Department of Conservation and Recreation's Recreational Trails Program. Aquatic restoration efforts could be funded through the FishAmerica Foundation Grants, MA Department of Fish and Game Division of Ecological Restoration Priority Projects, and the ACOE Aquatic Ecosystem Restoration grant. Shoreline restoration may be funded through the ACOE Emergency Streambank and Shoreline Protection grant. Refer to Table 18 for eligibility requirements, which have been tailored to pertain to the improvements planned for The Res.

Additionally, there are many stand-alone items within the Phase II program that are great candidates for alternative sources of funding, such as the playground, the beach volleyball court, the wayfinding and/or interpretive signage and the pavilion. There is also an opportunity for volunteer groups to take on some limited elements of the improvement plans.

Potential Funding Strategy

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MAINTENANCE AND MONITORING CONSIDERATIONS

The Town of Arlington's Public Works Department (DPW) provides maintenance and upkeep services at Arlington Reservoir. Typical costs for maintenance and upkeep of park, recreation, and open space priorities can vary somewhat dramatically based on the extent and type of facilities that are located within a given property. The type of maintenance activity varies depending on the nature of the area being maintained. The following is a general outline of maintenance activities that are need to properly maintain a property of this nature:

WEEKLY

- Mow lawn areas during the growing season.
- Remove trash (daily, multiple times per week or weekly) depending on the season and schedule of events. Visually inspect the property and remove any trash, large weeds or dead plant material.
- Clean, sweep, sanitize and stock supplies in the Men's and Women's restrooms on a daily basis. Ensure that all toilets and sinks are operating properly and free of leaks or clogs.
- Sweep paved areas, including the main parking lot, drop-off area, arrival plaza and pathways, or other areas subject to collecting debris in conjunction with regular grass mowing activities or on an as-needed basis.
- If engineered wood mulch surfacing is used, weekly inspection is needed and raking may be required on a weekly basis, especially under swings and at slide bottoms.
- Perform regular leaf blowing on the trail portions closest to the beach as well as the bathing beach and porous paving areas and their associated concrete pathways.
- Inspect signage regularly; any graffiti should be promptly removed.
- Conduct an invasive species monitoring program as detailed on the following pages.

SEASONALLY/ANNUALLY

- Lay nutrient applications to lawn areas for enhanced turf growth, weed and pest control.
- Spread mulch around planting beds and trees. Mulched areas should be maintained at no less than three inches deep to suppress weeds, retain moisture, dress up the planting beds and encourage soil microbiology. Keep mulch away from base of stems and trunks.
- Monthly visual inspections of playground equipment and safety surfacing should be conducted to observe wear and repair any damage that may occur. A yearly detailed visual inspection is recommended.
- Visually inspect both new and existing tree, shrub and groundcover plantings to identify damaged or diseased trees requiring pruning or removal/replacement.
- Clean the catch basins and other drainage structures to ensure they remain clear of debris and effectively remove storm water from the site.
- New porous pavement should be inspected several times in the first few months after construction to ensure proper installation and drainage. After the first few months of installation, visually inspect it annually and after major storms to check for surface ponding that might indicate possible clogging. Vacuum sweeping of porous pavement should be performed at least twice per year. See section on the following page on porous pavement for further detail on maintenance protocols.
- New rubber-based flexible pavement should be inspected several times in the first year of installation to ensure proper installation and drainage. Perform periodic leaf blowing to prevent natural compost material from forming, accumulating and decaying within the rubber-based flexible pavement so as to not promote the growth of plant seeds, or weeds. In the event that the surface becomes clogged with fine dirt or sand, copious amounts of water should

be applied at low pressure using a garden hose. Do not use pressure washers or abrasive devices such as sweepers on the surface. It is recommended that the manufacturer's recommendations are followed for additional maintenance measures.

- The bathing beach water should be tested daily per state bathing beach requirements. Any findings should be reported to the Town's Board of Health.
- Perform seasonal and emergency maintenance of the reservoir's water level via the outflow gate.
- Remove any seasonal, movable items, such as picnic tables, into a designated storage area, either within the Pump House Building or the Bathhouse and Concession Building.

AS NEEDED

- Complete minor repairs (e.g., replacement/repairs fencing and gate fabric and hardware, playground equipment)
- Repair hardware and bracing that has come loose or is damaged on benches and other site furnishings. Ensure seating surfaces and table tops are clean and free of protrusions and nuts, bolts and/or screws are flush with the surface. Remove any graffiti and ensure that painted surfaces are in good condition, free of rotten wood or rusted metal (dependent on furnishing selections).
- Visually inspect the condition of the beach volleyball court to ensure that court endlines and sidelines are secured, nets are free of tears, support poles have hardware intact and properly anchored and sand is smooth, level and well drained.
- Maintain the play equipment to Consumer Product Safety Commission (CPSC) and American Society for Testing and Materials (ASTM) standards; set a Certified Playground Safety Inspector (CPSI) inspection schedule based on use, location, materials, etc.
- During winter, snow plowing of the main parking lot and sidewalks on an as needed basis.
- Paint striping at parking areas every three to five years.
- Visually inspect the Pump House Building and Bathhouse and Concession Building to ensure compliance, safety, and proper operation. Visual inspection should include ensuring that all surfaces are cleanly painted and secure; doors, windows, screens and locks are operational; utility fixtures (electrical panels, plumbing, HVAC, and appliances) are in good working order; fire extinguishers are mounted in their proper location and up-to-date; and the roofs are free of debris and leaks.

Note that this list is not comprehensive and should not substitute for an Operations and Maintenance Plan after implementation has been completed. As funding is pursued and as actual improvements are implemented at Arlington Reservoir, it is important to consider other design and operational approaches (to be adopted now and in the future) in order to simplify and reduce maintenance requirements.

Porous Pavement

It is very important that sand and abrasives not be used for winter maintenance, as they will clog the pores; de-icing materials should be used instead. Porous asphalt tends to retard the formation of ice on the pavement surface, so that the use of de-icing compounds may be drastically curtailed. Snow should be removed with a rubber-tipped shovel or plow. The plow should be kept one inch above the surface. The remaining snow will melt and drain through. Snow piles containing sand (or mulch, soil, or any other granular material) should not be stored on porous pavement.

Accumulated sediment should be removed at least every two to three years. If the porous pavement is damaged, it can be repaired using conventional, non-porous patching mixes, as long as the cumulative area repaired does not exceed 10 percent of the paved area. It is important that sealant

is not applied over the porous pavement because it will prohibit water from passing through the material. The pavement should not be power washed because debris may be pushed further into the pavement and cause clogs as a result. Construction staging should not be performed on unprotected pavement as well.

If clogging becomes an issue, there are a few courses of action to take. First, remove any weeds and vegetation from the surface. Weeds and moss can be removed by hand or with a weed torch; do not use pesticides. Try a more powerful vacuum to deep clean most effectively. If the pavement ultimately fails, it may be worth doing a structural evaluation to ensure it was installed correctly. It is also important that a redundant drainage system be built into the initially such that the porous pavement can act as like conventional pavement if all methods have been exhausted to fix it.

Invasive Species Monitoring Program

Conducting an invasive species monitoring program during the growing season (April 15 to October 15) is recommended at The Res. Several 10-foot by 10-foot plots should be established within the limit of work in areas where invasive species were removed.

Upon invasive species removal, the plots should be monitored by a wetland scientist each spring and fall over three consecutive years to determine percent dominance and percent cover of invasive species identified within the investigation area. The wetland scientist should take photographs at the same specified locations from a fixed point such that visual comparisons can be made during future monitoring events. After each monitoring event, proper documentation should be kept for reference and used for future monitoring and control of each site.

Table 17. Summary of Work to be Completed During Monitoring Efforts	
Visual Inspections	Inspect the restoration area for presence of potential impacts. Inspections will include the identification of wildlife damage, vegetative distress, and evidence of seeps, wetland impacts and surface water concerns, if present.
Invasive Species Monitoring	Monitor the restoration area for invasive species by evaluating established monitoring plots for the presence of more than 10% of invasive species.
Vegetation	Monitor of overall vegetation health including the requirement to maintain at least 90% vegetative cover.
Wildlife Habitat Functional Assessment	Evaluate the bio-stabilization techniques to determine the functional ability to provide wildlife habitat.
Stability Monitoring	Evaluate the stability of the bio-stabilization techniques including the presence of breaches, lack of vegetation, erosion, sloughing, or any other failures.

The following monitoring schedule has been established:

Table 18. Monitoring Schedule		
	Phase I	Phase II
Construction Period	Fall 2018 to Spring 2019	Fall 2019 to Spring 2020
Post-construction Monitoring	Summer/Fall 2019	Summer/Fall 2020
Year 1	Spring 2020, Fall 2020	Spring 2021, Fall 2021

Table 18. Monitoring Schedule		
Year 2	Spring 2021, Fall 2021	Spring 2022, Fall 2022
Year 3	Spring 2022, Fall 2022	Spring 2023, Fall 2023

At any time during the monitoring period, if 10% of invasive species or more are found within any plot, work should be conducted to remove all invasive species from the entire investigation area. Removal operations should be conducted by Town personnel and overseen by a trained wetlands scientist. If invasive species are found, all plant material including root mass, stolons, and rhizomes will be removed to prevent re-sprouting from occurring. This will be completed using hand tools. The vegetation will be placed inside plastic bags, so seeds do not spread to any non-impacted areas. When leaving the work area, all equipment and clothing used during removal must be cleaned to remove seed material before entering non-impacted areas.

The information gathered during the monitoring events should be incorporated into annual reports and completed at the end of 2020, 2021, and 2022 for Phase I and 2021, 2022, and 2023 for Phase II. The annual reports should then be submitted to the Conservation Commission. This report would detail invasive species identification, methods of invasive species control (if necessary), including the timing and frequency of control and the success of control methods, anticipated follow-up monitoring efforts, and photographs of monitoring plots.

Additional Items to Consider

In addition to the maintenance and monitoring protocols noted above, the Town should consider the use of a dumpster (or multiple) within the bathing beach area. If it is determined that dumpsters are preferred, they should be located in inconspicuous spots that are easily reached for weekly pickup. Several moveable trash and recycling receptacles should be located in the vicinity of the bathing beach entrances such that they are either easily accessed by DPW maintenance vehicles or trash bags are easily collected by bathing beach staff. Trash and recycling receptacles should be rolled in and rolled out at the beginning and end of the bathing beach season. All other waste generated outside of the bathing beach, such as dog waste, should be carried in and carried out. Signage at opportune locations along the reservoir's perimeter pathway should indicate to visitors that this policy prevails.

APPENDICES

APPENDIX A

MEETING NOTES

TO: Jon Marshall

FROM: Cheri Ruane, RLA & Cass Chroust, RLA

DATE: October 28, 2017

SUBJECT: Arlington Reservoir Master Plan Public Meeting #2 – October 26, 2017

ATTENDEES: Approximately 20 residents and community members
Jon Marshall, Director of Arlington Parks and Recreation
Lela Shepard, Arlington Conservation Agent
David White, Arlington Reservoir Committee
Ann LeRoyer, Arlington Open Space Committee
Leslie Mayer, Arlington Community Preservation Committee
Don Vitters, Arlington Parks and Recreation Commission
Cheri Ruane, Cass Chroust, Weston & Sampson

NOTES:

1. When considering new plantings, consider shrubs with edible berries.
2. Wayfinding in the Res needs improved to help navigate the immediate and surrounding context. Signage in Lexington, MA was mentioned as a good precedent to follow.
3. Questions about a perceived reduction in water fowl at the Res were asked and the water was being lowered too much. The value of the Res as an environment that supports diverse water fowl was reiterated. It was also stated that an increase in invasive vegetation could have a negative impact on water fowl populations.
4. Fix the paths that are difficult to navigate due to the tree roots, but do not damage the trees. Possible solutions discussed included relocating the path and installing flexipave surfacing.
5. Several participants stated that the more “natural” trails around the Res were their favorite.
6. At the parking lot, a question was asked if permeable paving could be used similar to that recently installed at the nearby Drake Village.
7. Participants asked if the town could collaborate with Lexington to improve the interface between Ringe Park and the adjacent Res pathway.
8. Participants asked if a new playground could be more “natural”.
9. A safe crosswalk near the Lowell Street entrance would be great.
10. Participants brought up concerns about the use of chlorine in the swimming area and that the town should consider stopping its use of the chemical.

11. Better access to the water was requested for canoe/kayak launches in the warmer months and ice skating in the winter months.
12. Questions about how this plan will be funded and implemented were asked. The town is still determining how it will proceed, but will likely pursue CPA funding and Weston & Sampson will also identify other potential funding sources.
13. It was mentioned that the town currently uses the existing parking area as a staging area and lay down area for downed trees and snow removal. Once the parking lot is improved, however, this will need to be reconsidered.

MEETING NOTES

TO: Jon Marshall

FROM: Cheri Ruane, RLA & Cass Chroust, RLA

DATE: October 28, 2017

SUBJECT: Arlington Reservoir Master Plan Public Meeting #2 – October 26, 2017

ATTENDEES: Approximately 20 residents and community members
Jon Marshall, Director of Arlington Parks and Recreation
Lela Shepard, Arlington Conservation Agent
David White, Arlington Reservoir Committee
Ann LeRoyer, Arlington Open Space Committee
Leslie Mayer, Arlington Community Preservation Committee
Don Vitters, Arlington Parks and Recreation Commission
Cheri Ruane, Cass Chroust, Weston & Sampson

NOTES:

1. When considering new plantings, consider shrubs with edible berries.
2. Wayfinding in the Res needs improved to help navigate the immediate and surrounding context. Signage in Lexington, MA was mentioned as a good precedent to follow.
3. Questions about a perceived reduction in water fowl at the Res were asked and the water was being lowered too much. The value of the Res as an environment that supports diverse water fowl was reiterated. It was also stated that an increase in invasive vegetation could have a negative impact on water fowl populations.
4. Fix the paths that are difficult to navigate due to the tree roots, but do not damage the trees. Possible solutions discussed included relocating the path and installing flexipave surfacing.
5. Several participants stated that the more “natural” trails around the Res were their favorite.
6. At the parking lot, a question was asked if permeable paving could be used similar to that recently installed at the nearby Drake Village.
7. Participants asked if the town could collaborate with Lexington to improve the interface between Ringe Park and the adjacent Res pathway.
8. Participants asked if a new playground could be more “natural”.
9. A safe crosswalk near the Lowell Street entrance would be great.
10. Participants brought up concerns about the use of chlorine in the swimming area and that the town should consider stopping its use of the chemical.

11. Better access to the water was requested for canoe/kayak launches in the warmer months and ice skating in the winter months.
12. Questions about how this plan will be funded and implemented were asked. The town is still determining how it will proceed, but will likely pursue CPA funding and Weston & Sampson will also identify other potential funding sources.
13. It was mentioned that the town currently uses the existing parking area as a staging area and lay down area for downed trees and snow removal. Once the parking lot is improved, however, this will need to be reconsidered.

MEETING NOTES

TO: Jon Marshall

FROM: Cheri Ruane, RLA & Cass Chroust, RLA

DATE: December 6, 2017

SUBJECT: Arlington Reservoir Master Plan Public Meeting #3 – November 30, 2017

ATTENDEES: 25 residents and community members

Jon Marshall, Director of Arlington Parks and Recreation
Lela Shepard, Arlington Conservation Agent
Nathaniel Stevens, Arlington Conservation Commission
David White, Arlington Reservoir Committee
Ann LeRoyer, Arlington Open Space Committee
Don Vitters, Leslie Mayer, Jen Rothenberg, Shirley Canniff, Crissy Tarantino, Elena Barthalemew, Arlington Parks and Recreation Commission
Cheri Ruane, Cass Chroust, Jim Riordan & Mark Mariano, Weston & Sampson

NOTES:

1. Jennifer from P&R Commission asked if we could consider relocating the pump house and / or combining the bathhouse / concession building with the mechanical room. Additionally, several meeting participants suggested relocating the water treatment building. W&S will consider alternatives to do this and approximate cost. One suggestion was to add the treatment system to an auxiliary part of the bathhouse.
2. There is clarity needed about dog regulations on the Arlington land that is within the Town of Lexington as the two towns have different rules.
3. There are a lot of bags of picked up dog feces around the playground because there are no trash cans nearby, can more trash receptacles be added and can pick up be more frequent? A dog waste station was also suggested with the potential for it to be maintained by a dog advocacy group.
4. Questions about the water quality of the Res (outside of the bathing beach) were asked and answered noting the number of algae and invasive species of plants that were found in the Res reducing visibility to a sub-optimal level. Operational techniques for ongoing management will be recommended to improve water quality as part of the master plan. This will include nonpoint source pollution mitigation at the outfalls around the Reservoir.

5. Discussion about the trail around the Res confirmed that people do not want asphalt and understand that stone dust is not maintainable by the DPW. Flexi-Pave is being used by Cambridge and will be reviewed by interested attendees as a potential surfacing.
6. The bathing beach at the Res is an intensely used community resource for residents with 11,500 day tags sold and another 800 season passes sold last year for swimming. It is also a revenue generator, which is an important consideration. The mechanical equipment is well beyond its prime and failed 12 times last season requiring emergency repairs. This is only expected to worsen. Minor repairs at this point may prolong the life of the system for short period of time, but ultimately the entire system must be removed and replaced.
7. DPW currently uses parts of the park for snow stockpiling and materials (e.g., aggregate) storage. Once the facilities are upgraded, these practices will need to be discontinued. Participants questioned where this necessary stockpiling and storage will be done instead.
8. Questions about the proposed filtration improvements were asked and answered. UV Light will supplement other filtration as well lower concentrations of chlorine. The system will be far more efficient and require less manpower to operate.
9. The parking lot was discussed at length. Currently there is no formal layout which decreases safety and control but increases the parking capacity by about 15-18 cars. A lot that is paved (with a pervious material) and striped would accommodate less cars than are currently able to be fit in (about 54 currently with about 36 proposed in the new layout). Concerns about this reduction were raised. W&S to see if additional spots can be fit in along the road or further into the site where the turnaround is located.
10. Participants asked that W&S consider the need for pedestrian safety practices and other traffic controls (e.g., speed bumps) though this is outside the scope of the work.
11. Participants asked about the possibility of relocating staff parking (e.g., "over by the field").
12. A new boat ramp may be relocated to provide more optimal access for personal non-motorized craft as well as water chestnut harvesting equipment.
13. Access to the playground from the beach is incredibly important to the families that use the beach on a regular basis. However, at the end of the day, when the beach is closed, the gates are locked and the playground is inaccessible to the general public. A control system that would allow for access to the play area when the beach is closed is being considered.
14. Exotic invasive vegetation will be managed through the Master Plan.
15. Participants discussed the possibility of creating a maintenance plan as a CPA grant.

MEETING NOTES

TO: Jon Marshall

FROM: Cheri Ruane, Cassie Bethoney

DATE: April 16, 2018

SUBJECT: Arlington Reservoir Master Plan Public Meeting #4 – April 3, 2018

ATTENDEES: roughly 25 residents and community members
Jon Marshall, Director of Arlington Parks and Recreation
David White, Arlington Reservoir Committee
Ann LeRoy, Arlington Open Space Committee
Leslie Mayer, Arlington Community Preservation Committee
Don Vitters, Arlington Parks and Recreation Commission
Cheri Ruane and Cassie Bethoney, Weston & Sampson

NOTES:

1. Once CPA funds have been approved, it is easier to seek other funding using CPA as a match. A similar situation is happening at Spy Pond.
2. There was some discussion on the parking lot and as to why so many spots were included (50 spots). The parking lot material is proposed as permeable asphalt, which would need to be commercially vacuum swept annually in order to maintain permeability over time. However, the design team discussed the incorporation of a redundant drainage system that would collect any additional water flowing during major storm events or if the asphalt failed in the future.
3. Companies sponsor staff outings to remove water chestnuts from the reservoir, which is helpful, but not a long-term solution. The design team discussed the method by which regular maintenance at two strategic moments during the season before seeds drop will work to remove the water chestnut issue from the water body over time.
4. Clarification was given about the trail that is proposed to run along the top of the berm separating the bathing beach from the Res. This pathway is currently overgrown and three feet wide, if that in places. A new stone dust pathway would be five feet wide and connect to the overall trail pathway system such that people would no longer need to leave the park and walk along Lowell Street in order to walk the entire perimeter trail. A resident noted that Arlington High School's cross country ski team makes use of the trails during the winter and would benefit from not having to ski along Lowell Street.
5. Discussion about the flexi-pave system, how it performs, and how it interfaces with adjacent materials along the trail. The flexi-pave system is not only pervious, but it provides an accessible

and inclusive surface that will allow people of all abilities to traverse the areas along the trail that have the most extreme protrusion of tree roots and difficult conditions to walk over.

6. There was a call for more bike parking, with space allocated for hitching trailers that connect to the back of the bike.
7. Wayfinding for bikes and pedestrians was also important to attendees. It would be helpful to point toward nearby bike trail or walking path connections and signs from Minuteman bike path. Eliminate the existing signage that is not serving the public sufficiently.
8. A question was raised about the use of black vinyl chain link fence and if there is any potential along Lowell Street to incorporate a more visually appealing stretch of fence. The black vinyl chain link fence was selected for this project because of its low cost and low maintenance; however, the design team is open to the possibility of using a more decorative fence strategically in places.
9. Traffic calming measures are underway along Lowell Street as part of a separate project. Those plans are being coordinated with this master plan for the Res, but the work is out of this scope.
10. The nature, materiality and purpose of the terraced seating was discussed.
11. A tentative timeline for Phase 1 was discussed. If approved at Town Meeting, design and engineering for Phase 1 can begin shortly after July 1, 2018. Construction would begin after the 2018 summer season and conclude in early to mid-spring of 2019 in anticipation of the summer 2019 beach season. Trail construction would be coordinated such that it happens in the least disruptive manner possible. The beach will be open this summer (2018) as well, so long as the pump equipment is operational for a final year.
 - a. All permitting required to complete Phase 1 would be sought in a timely manner during the Phase 1 design process (including such permits as filing an NOI to the Lexington and Arlington Conservation Commissions).
12. The Town of Lexington has been consulted on this master plan throughout the process.
13. Note that Busa Farm is named 'Lexington Community Farm'.
14. Discussion about beach pass fees. All money collected from these fees go to a recreation enterprise fund and are reinvested into Arlington Parks and Recreation.

APPENDIX B

From: bausman@rcn.com
To: [Chroust, Cassidy](#)
Subject: Arlington Res
Date: Friday, October 27, 2017 12:24:57 PM

Hi Cass,

I am a local neighbor who hasn't been to any of the Arlington Res meetings but wanted to chime in with my thoughts! My kids are now 18 and 20 and pretty much grew up going to the Res year-round. Once they were in middle and high school I often thought that there should be a basketball court. The underutilized parking lot near the climbing structure seems to be a perfect fit for this! I could see the older kids using it year round.

otherwise, i think many of my other comments have been addressed (I just looked through the slide show).

Thanks! Ann Bausman 148 Westminster Ave

From: Jon Marshall
To: [Chroust, Cassidy](#)
Subject: Fwd: Re: Reservoir Beach Public Input Meeting 10/26/2017
Date: Friday, October 27, 2017 8:51:43 AM

Cass-

FYI Res Feedback.

Jon Marshall
Director of Recreation
Town of Arlington
781 316-3880
arlingtonma.gov/recreation

-----Original Message-----

From: "Rec Office" <RecOffice@town.arlington.ma.us>
To: "Jon Marshall" <JRMarshall@town.arlington.ma.us>
Date: Fri, 27 Oct 2017 08:42:27 -0400
Subject: Fwd: Re: Reservoir Beach Public Input Meeting 10/26/2017

-----Original Message-----

From: Carolina San Miguel <carolsanmiguel@yahoo.com>
To: Arlington Recreation <recoffice@town.arlington.ma.us>
Date: Thu, 26 Oct 2017 22:17:00 +0000 (UTC)
Subject: Re: Reservoir Beach Public Input Meeting 10/26/2017

Hi,

I'm a resident at Arlington Heights and also an architect and urban planner. I won't be able to make it for the public town meeting tonight for suggestions on the reservoir but i do have many and would like to be engaged in this.

I'm doing my doctoral research on better strategies for implementing child friendliness in neighborhoods. I use the reservoir a lot, and from my experience, perception and background, I think we are missing more family friendly swimming places for all ages and along the entire year, specially in winter. Boston, Somerville, Cambridge, have public swimming pools and even Lexington has the pools that you pay 5 bucks but we don't. And we should. I feel like an all season water park would be something to consider for the town.

For the reservoir specifically, it should be open longer, start earlier and close later. It should also have water fountain to drink, like the Lexington reservoir. It should have at least 2 showers inside. It's great for kids but not so good for elderly or adults to swim, the Lexington one is better to swim, so I fell like it should be extended, made bigger for that too, it's a rather small pool.

I think instead of having just one night in September for adults it should be more open to all ages, and promote town sports events, music (already implemented, I know), have a snack/restaurant for night events, for example, with nice local musicians have the possibility to do private events, like weddings, or something, to fund raise, along the year, have day family days over fall and winter and turn the reservoir into an ice

skating ring in winter.

Got a couple of more suggestions so if you need we can find a time and I can meet you guys and help collaborate. Would love to. I have tons of pictures of the reservoir from all times of the year too!

Thanks a lot and good luck at the meeting tonight.

Warmly,

Carolina San Miguel

Co-Founder, Brazil GSD
Doctoral Candidate, Harvard Graduate School of Design
Teaching Fellow, Department of Architecture, Harvard GSD
Innovation Capacity Strategist, Harvard Center on the Developing Child

MAS Housing ETH. MA Strategic Design IED.
BA Architecture & Urbanism CAU-MG Brazil

+ 1 781 353 1797 (USA)
+ 55 31 98981 7888 (BRA)

csanmiguel@gsd.harvard.edu

Em qua, 18/10/17, Arlington Recreation
<arlingtonrec.com@myrecdepartment.com> escreveu:

Assunto: Reservoir Beach Public Input Meeting 10/26/2017
Para: "Carolina San Miguel" <carolsanmiguel@yahoo.com>
Data: Quarta-feira, 18 de Outubro de 2017, 15:11

Recreation Department Invoice

422 Summer Street, Arlington, MA. 02474 •
781-316-3880 • <http://www.arlingtonrec.com/>

We
need your input! Help Arlington plan the future of the
Arlington Reservoir. Come to the public input session
Thursday, October 26 6:30pm at Arlington Town Hall
Auditorium.
Click [HERE](#) for more
information.

Sent to: San
Miguel account at carolsanmiguel@yahoo.com

To Opt out of our email list please click
here to unsubscribe

From: Jon Marshall
To: [Chroust, Cassidy](#)
Subject: Fwd: Reservoir Plans
Date: Thursday, October 26, 2017 3:35:46 PM

Cass-

Here is some feedback. I let her know where she could go for her detailed response.

Thanks,

Jon Marshall
Director of Recreation
Town of Arlington
781 316-3880
arlingtonma.gov/recreation

-----Original Message-----

From: "Rec Office" <RecOffice@town.arlington.ma.us>
To: "Jon Marshall" <JRMarshall@town.arlington.ma.us>
Date: Thu, 26 Oct 2017 13:30:26 -0400
Subject: Fwd: Reservoir Plans

-----Original Message-----

From: strutnpuppy@gmail.com
To: RecOffice@town.arlington.ma.us
Date: Thu, 26 Oct 2017 11:06:24 -0400
Subject: Reservoir Plans

Hi guys!

What is the plan for the Res? I can't make the meetings but wanted to send in my suggestions. I would love a detailed response about what is planned too.

My suggestions -

- 1) keep it on-leash all the way around all the time
- 2) open the beach on Memorial Day and close it on Labor Day
- 3) get rid of the weed garden on the side near Hurd Field. It just becomes overgrown with weeds and tall grass.
- 4) add more trash receptacles for dog owners and other litter
- 5) ban fishing

Thanks!
Daria

Daria Pannesi
Chief Tail Wagger
www.strutnpup.com
Facebook.com/StrutnPup

From: Jon Marshall
To: [Chroust, Cassidy](#)
Subject: Fwd: Res project feedback
Date: Monday, November 27, 2017 9:12:06 AM

Cass-

FYI.

Jon Marshall
Director of Recreation
Town of Arlington
781 316-3880
arlingtonma.gov/recreation

-----Original Message-----

From: "Rec Office" <RecOffice@town.arlington.ma.us>
To: "Jon Marshall" <JRMarshall@town.arlington.ma.us>
Date: Mon, 27 Nov 2017 09:09:17 -0500
Subject: Fwd: Res project feedback

-----Original Message-----

From: John Fitzpatrick <jdfitzlaw@gmail.com>
To: RecOffice@town.arlington.ma.us
Date: Wed, 22 Nov 2017 08:19:16 -0500
Subject: Res project feedback

The Res, despite its advertised impeccable water quality, looks like a mud puddle. It is not an inviting place to take your family for a swim. I never once used it while raising my family here, and instead belonged to a private pool club in Belmont. By contrast, I suspect I'm not the only Arlingtonian who's a tad jealous when I drive by Belmont's impressively rebuilt, shiny new municipal pool complex on summer days, always crowded with families out for a swim. On the other hand, though the Res does not seem heavily used, if its annual cost is minimal, that may be an acceptable trade off. The ultimate cost/benefit question is whether it is worthwhile to invest in creating a more attractive swimming facility for the Town, and if so, how much will it cost? If Arlington wants to continue renewing itself by attracting young families, a family friendly swimming spot should be on its capital improvement to-do list. Also favoring such an investment is Arlington's size. Though we still function as a Town, we really have the population of a small city. Given our size, having a decent municipal swimming place may not be a necessity, but it would at least be seen as a reasonable expectation.

Thanks for soliciting public input, and good luck making the right call!

John Fitzpatrick
Foxmeadow Lane (Turkey Hill)

Sent from my iPhone

From: Jon Marshall
To: [Chroust, Cassidy](#)
Subject: Fwd: comments for REs Master Plan
Date: Wednesday, November 8, 2017 11:57:15 AM

Cass-

Some feedback.

Jon Marshall
Director of Recreation
Town of Arlington
781 316-3880
arlingtonma.gov/recreation

-----Original Message-----

From: "Rec Office" <RecOffice@town.arlington.ma.us>
To: "Jon Marshall" <JRMarshall@town.arlington.ma.us>
Date: Wed, 08 Nov 2017 08:56:21 -0500
Subject: Fwd: comments for REs Master Plan

-----Original Message-----

From: Susan Hargrave <suahargrave@gmail.com>
To: RecOffice@town.arlington.ma.us
Date: Wed, 8 Nov 2017 08:23:24 -0500
Subject: comments for REs Master Plan

Hello,

I'm sorry that I will not be able to attend the meetings. I live near the reservoir, and go there frequently. Here are a few comments:

I would like to see swimming water free of debris: can't the lifeguards use nets (like used for swimming pools) to remove feathers, grass, leaves, and other debris? They always seem to be raking the sand, but I can't figure out why.

I would like to see the swimming area open at least until Labor Day; that's a great time for people to go somewhere local and not face the highway traffic, and it's always hot.

I would like to see the parking lot repaired. It would be nice to use the asphalt-type material they use at Walden Pond, which allows rain water to seep through to the ground below.

I would like to see the fence maintained or removed where not needed.

I noticed the other day I noticed that people had picked up their dogs' poop but had nowhere to put it. One of the planters near the picnic area was filled with little bags of poop.

I would like to see the wooden Res sign/map fixed. It's probably years 20 years since it was damaged. It makes it look like no one is taking care of the Res.

On the side of the Res near the farm, it would be nice to use wood chips

to cover the roots on the path. This has been done in some years but not others.

I realize that the invasive weeds are a challenge, but I would like to see them gone. If Lexington is the problem, perhaps Arlington needs to think up strategies to encourage them to do their share of the work.

Thank you.

Susan Hargrave
170 Lowell Street

From: Jon Marshall
To: [Bethoney, Cassie](#)
Subject: Fwd: The Res
Date: Tuesday, April 3, 2018 11:33:48 AM

Cassie-

See below.

Jon Marshall
Director of Recreation
Town of Arlington
781 316-3880
arlingtonma.gov/recreation

-----Original Message-----

From: "Rec Office" <RecOffice@town.arlington.ma.us>
To: "Jon Marshall" <JRMarshall@town.arlington.ma.us>
Date: Tue, 03 Apr 2018 09:27:09 -0400
Subject: Fwd: The Res

-----Original Message-----

From: Oakes Plimpton <opoakes@gmail.com>
To: RecOffice@town.arlington.ma.us
Cc: "David E. White" <dwhite@gilbertwhite.com>, Karsten Hartel <karstenehartel@gmail.com>, Keith Ohmart <kohmart@verizon.net>, Jane Howard <phoward795@horizon.com>, Catherine Garnett <cgarnett251@gmail.com>, Mike Tabacynski <mjtspam4@gmail.com>, Donald Miller <donaldbmiller@comcast.net>, Ann LeRoy <annleroyer12@gmail.com>
Date: Tue, 3 Apr 2018 08:44:18 -0400
Subject: The Res

Master Plan comments: I like to walk around the Res for an outing and to bird watch. I wish that the Res paths, especially the berm trail, remain open during the Spring and the Fall. It often closes in the Fall as I remember. Sorry, I object to the visual pollution of the blue signs around the Res promoting the Colonial Hat of Lexington with the single word ACROSS on it. The Colonials clear cut the forests and killed all the wildlife. I would have no objection to a green sign indicating the Res Path is part of the Across Lexington trail system (with a graphic of Will Lang!) (or a boy or girl with pack).

The other problem is that the ACROSS signs do not indicate direction. There should be a sign indicating the first trail to the left on the NW side of the Res goes to the Cataldo Reservation and the Bike Path, and that the 2nd trail to the left just before you come to the outlet of the brook goes to public streets (follow signs to Great Meadows park). Then after the brook there is a short steep trail to the left which you could take to walk along the edge of the woods to go to Silk Fields where goats and Alpacas are to be looked at (public invited). Pat and I did so last Saturday (talked with attendant). Then further along comes Lexington Community Farm. There should be a sign where the view is unblocked by bushes to indicate same (look but do not enter).

I would be game to contribute towards the artistic and professional rendering of the signs described above. I hope to come to the meeting tonight.

Oakes Plimpton

ps: Who decides on the lowering and rising of the water in the Res?? Should include a conservation / wildlife representative. I noticed a lot of those water chestnut barbs on the sand bar. We saw Buffleheads, Ring-necked Ducks, Black Ducks, Green-winged Teals, Killdeer, Mallards and Canada Geese of course on Saturday, Red-winged Blackbirds three weeks ago! Below (sample of replacement for Colonial Hat!)

O.P.



APPENDIX C

ARLINGTON RESERVOIR MASTER PLAN

WALKABOUT GUIDE

please answer as you see fit

Activities and facilities that would improve Arlington Reservoir

include: healthy food offerings, more tables for lunch, move
changing rooms, spray park 5 yr olds says - water slide and
water playground

The best things about Arlington Reservoir are: _____

the scale for little kids, neighborhood feel

I wish Arlington Reservoir had more: _____

cleaner bathrooms, changing
space / tables for babies, hours in summer - season ends too
early.

I wish Arlington Reservoir had less: _____

gases!

What is missing in Arlington Reservoir? _____

a full summer schedule, lunch options

CONTACT INFORMATION (optional): _____

ERW
powers.lawler@gmail.com

Please leave this guide at the workstation where you picked up your clipboard. If you think of more to say later, please visit:

<http://www.arlingtonma.gov/departments/recreation/capital-projects>

<http://arlingtonreservoir.org/reservoir-master-plan/>

ARLINGTON RESERVOIR MASTER PLAN

WALKABOUT GUIDE

please answer as you see fit

Activities and facilities that would improve Arlington Reservoir

include: BETTER WALKING PATHS & MAINTENANCE —
SOLVE THE INVASIVE PROBLEM

The best things about Arlington Reservoir are: _____

HAPPY GARDEN, WILDLIFE ABUNDANT, WALKING
TRAILS

I wish Arlington Reservoir had more: # TRAIL MAINTENANCE;

INFORMATION ON WILDLIFE VIEWING OPPORTUNITIES - I.E.,
LOOKOUT & OBSERVATION VIEWPOINTS

I wish Arlington Reservoir had less: INVASIVE PLANT SPECIES;

YOUNG TREES - TRAIL MAINTENANCE & VISION 2020 COMMITTEE
ESPECIALLY

What is missing in Arlington Reservoir? PUBLIC ART & RECOMMENDED

WILDLIFE VIEWING SITES (I.E. BEST PLACE TO VIEW)...

CONTACT INFORMATION (optional): _____

Please leave this guide at the workstation where you picked up your clipboard. If you think of more to say later, please visit:

<http://www.arlingtonma.gov/departments/recreation/capital-projects>

<http://arlingtonreservoir.org/reservoir-master-plan/>

ARLINGTON RESERVOIR MASTER PLAN

WALKABOUT GUIDE

please answer as you see fit

Activities and facilities that would improve Arlington Reservoir

include: better trail maintenance + invasive control
water chestnuts cleared out (lotus weed, bittersweet)

The best things about Arlington Reservoir are: natural resources
non-landscaped feeling - trail, garden
birds + wildlife activity

I wish Arlington Reservoir had more: maintenance
volunteers for Habitat garden work

I wish Arlington Reservoir had less: invasive plants

What is missing in Arlington Reservoir? public art + activities

CONTACT INFORMATION (optional): Ann LeRoyer
annleroyer12@gmail.com

Please leave this guide at the workstation where you picked up your clipboard. If you think of more to say later, please visit:
<http://www.arlingtonma.gov/departments/recreation/capital-projects>
<http://arlingtonreservoir.org/reservoir-master-plan/>

ARLINGTON RESERVOIR MASTER PLAN

WALKABOUT GUIDE

please answer as you see fit

Activities and facilities that would improve Arlington Reservoir include: Bigger swim area.

The best things about Arlington Reservoir are: Swimming!

I wish Arlington Reservoir had more: Sand in the swimming area - the pond bottom is slimy.

I wish Arlington Reservoir had less: ~~stuff~~ less stuff floating on the pond like leaves and feathers. Please skim the water better

What is missing in Arlington Reservoir? please keep it open for swimming thru Labor Day and keep it open later in the evening in June and July - People who work 9-5 would appreciate later hours when it is light out. It used to be open until 8pm.

CONTACT INFORMATION (optional): Mary McArthur
Marymccartney@yahoo.com.

Please leave this guide at the workstation where you picked up your clipboard. If you think of more to say later, please visit:

<http://www.arlingtonma.gov/departments/recreation/capital-projects>

<http://arlingtonreservoir.org/reservoir-master-plan/>

ARLINGTON RESERVOIR MASTER PLAN

WALKABOUT GUIDE

please answer as you see fit

Activities and facilities that would improve Arlington Reservoir

include: Not really an activity, but reducing the erosion on the
paths (such as path from habitat garden to Mud Field) and
clearing invasives on shoreline and in Res itself.

The best things about Arlington Reservoir are: habitat garden, path,
bench, open-space

I wish Arlington Reservoir had more: Funds to restore and protect
natural area around Res, paths, trees and shrubs.

I wish Arlington Reservoir had less: _____

What is missing in Arlington Reservoir? Not much! I love having the
Res in Arlington.

CONTACT INFORMATION (optional): Lfredman1@gmail.com

Please leave this guide at the workstation where you picked up your clipboard. If you think of more to say later, please visit:

<http://www.arlingtonma.gov/departments/recreation/capital-projects>
<http://arlingtonreservoir.org/reservoir-master-plan/>

ARLINGTON RESERVOIR MASTER PLAN

WALKABOUT GUIDE

please answer as you see fit

Activities and facilities that would improve Arlington Reservoir include: I like the new plantings

Bridge improvements.

The best things about Arlington Reservoir are: Nature, birds
walking trails, Willow Tree,

I wish Arlington Reservoir had more: year round
access

I wish Arlington Reservoir had less: I do not use
Swimming beach and think we could
do without it. if there were
other options for little kids in summer

What is missing in Arlington Reservoir? _____

CONTACT INFORMATION (optional): _____

Please leave this guide at the workstation where you picked up your clipboard. If you think of more to say later, please visit:

<http://www.arlingtonma.gov/departments/recreation/capital-projects>

<http://arlingtonreservoir.org/reservoir-master-plan/>

ARLINGTON RESERVOIR MASTER PLAN

WALKABOUT GUIDE

please answer as you see fit

Activities and facilities that would improve Arlington Reservoir include: _____

The best things about Arlington Reservoir are: Shade & grass on beach.
Beautiful path to walk on. Especially "nature-pati" part over by
Busa farm.

I wish Arlington Reservoir had more: Available beach hours in summer
(stay open later), and a longer open season. (swim at your own
risk is fine - works for entire Atlantic Ocean).

I wish Arlington Reservoir had less: GEESE on the beach. Scum in
the water. Closing off beach area for several weeks before/after swim
season allows them to settle in. Better water filter needed.
FAVOR STAY BY PLOT.

What is missing in Arlington Reservoir? _____

CONTACT INFORMATION (optional): _____

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<http://arlingtonreservoir.org/reservoir-master-plan/>

ARLINGTON RESERVOIR MASTER PLAN

WALKABOUT GUIDE

please answer as you see fit

Activities and facilities that would improve Arlington Reservoir

include: full use during summer season

The best things about Arlington Reservoir are: loop path

I wish Arlington Reservoir had more: Trash Cans, Plantings
for Banks

I wish Arlington Reservoir had less: Trash, Washed out Banks

What is missing in Arlington Reservoir? More Seating and
easier access to water

CONTACT INFORMATION (optional): laura.b@wisner.org

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<http://arlingtonreservoir.org/reservoir-master-plan/>

ARLINGTON RESERVOIR MASTER PLAN

WALKABOUT GUIDE

please answer as you see fit

Activities and facilities that would improve Arlington Reservoir

include: improve all here -
there is basketball across the Res - no additional

The best things about Arlington Reservoir are: seats, paths,
green, green, green

I wish Arlington Reservoir had more: mulch ground
the walk path surrounding pond

I wish Arlington Reservoir had less: invasive weed in
pond

What is missing in Arlington Reservoir? more climbing
stuff for kids / adults

CONTACT INFORMATION (optional): Lu Leveille
lnleveille1@gmail.com

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<http://arlingtonreservoir.org/reservoir-master-plan/>

ARLINGTON RESERVOIR MASTER PLAN

WALKABOUT GUIDE

please answer as you see fit

chroust@wseinc.com

Activities and facilities that would improve Arlington Reservoir

include: splash pad!! waterslide (suggested by my children!)

The best things about Arlington Reservoir are: swimming area,
nature path

I wish Arlington Reservoir had more: picnic benches, sand,
(music) concerts, regularly organized ie Sunday night
community event

I wish Arlington Reservoir had less: dog poop ☹

What is missing in Arlington Reservoir? longer swim season, more boating opportunities

CONTACT INFORMATION (optional): _____

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ARLINGTON RESERVOIR MASTER PLAN

WALKABOUT GUIDE

please answer as you see fit

Activities and facilities that would improve Arlington Reservoir

include: Better walking options, especially in
summer when beach is closed off.

The best things about Arlington Reservoir are: natural environment
walking paths

I wish Arlington Reservoir had more: benches

I wish Arlington Reservoir had less: invasive plants
land & water

What is missing in Arlington Reservoir? shoreline access
boat launch

CONTACT INFORMATION (optional): _____

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<http://arlingtonreservoir.org/reservoir-master-plan/>

ARLINGTON RESERVOIR MASTER PLAN

WALKABOUT GUIDE

please answer as you see fit

Activities and facilities that would improve Arlington Reservoir include: More goose deterrents, larger swim area, better SNACK bar.

The best things about Arlington Reservoir are: shade, beach, woods

I wish Arlington Reservoir had more: Off-leash hours, larger swimming area.

I wish Arlington Reservoir had less: Goose poo

What is missing in Arlington Reservoir? Better SNACK bar, maybe with tables and ice cream

CONTACT INFORMATION (optional): AllyMUNGENAST@yahoo.com

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<http://arlingtonreservoir.org/reservoir-master-plan/>

ARLINGTON RESERVOIR MASTER PLAN

WALKABOUT GUIDE

please answer as you see fit

chroustc@wseinc.com

Activities and facilities that would improve Arlington Reservoir include: Walking, walking, walking

The best things about Arlington Reservoir are: A bit of nature in a densely developed community/region

I wish Arlington Reservoir had more: Ø

I wish Arlington Reservoir had less: signs (1 sign in the parking lot should get folks to website)

What is missing in Arlington Reservoir? Maintenance on parking lot, path, lawn.

CONTACT INFORMATION (optional): _____

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<http://arlingtonreservoir.org/reservoir-master-plan/>

ARLINGTON RESERVOIR MASTER PLAN

WALKABOUT GUIDE

please answer as you see fit

Activities and facilities that would improve Arlington Reservoir

include: Clean enough water to take my
Surf in the water.

The best things about Arlington Reservoir are: Fall-Winter Walks

with Dog (beach open)
Summer + Spring walks - dogs can get in Res to
Cool off - Also Cross Country Skiing in the winter! Love it!!

I wish Arlington Reservoir had more: Wider paths

along Bush Farm area

I wish Arlington Reservoir had less: Less rules about

Dogs ^{off} ~~on~~ leash at the beach areas - more time
for off leash

Please no snow plowing!! - Bad for Skiing.

What is missing in Arlington Reservoir? Naturalist Education

What birds can you see? What other wildlife here and
how to protect them. Little Nature Education stops
along the path

CONTACT INFORMATION (optional): Sharon Kabelitz

Skabelitz112@gmail.com

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<http://arlingtonreservoir.org/reservoir-master-plan/>

ARLINGTON RESERVOIR MASTER PLAN

WALKABOUT GUIDE

please answer as you see fit

Activities and facilities that would improve Arlington Reservoir include: _____

The best things about Arlington Reservoir are: birds & path

I wish Arlington Reservoir had more: _____

I wish Arlington Reservoir had less: People sometimes conenig
in the Reservoir, ~~wat~~ except they take out the investive plant
would like to discourage the recreational usage

What is missing in Arlington Reservoir? _____

CONTACT INFORMATION (optional): _____

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<http://arlingtonreservoir.org/reservoir-master-plan/>

ARLINGTON RESERVOIR MASTER PLAN

WALKABOUT GUIDE

please answer as you see fit

Activities and facilities that would improve Arlington Reservoir

include: MORE COMMUNITY EVENTS AT THE RES TO
BENEFIT IT AND BUILD RELATIONSHIPS

The best things about Arlington Reservoir are: COMMUNITY
INVOLVEMENT, FAMILY-FRIENDLY, VERY AFFORDABLE,
RECENTLY EXPANDED MENU AT THE SNACK SHACK

I wish Arlington Reservoir had more: IF I UNDERSTOOD MY
WIFE CORRECTLY, SHE WOULD SAY: SWIMMING
LESSONS FOR KIDS (FOR A FEE OF COURSE)

I wish Arlington Reservoir had less: COUNTLESS ROCKS
ON THE BEACH

What is missing in Arlington Reservoir? NOT MUCH AT ALL.
MAYBE A BABY CHANGING STATION IN BOTH TOILET
ROOMS, OR A COMMON SHOWER AREA FOR THE EXIT.

TOM MCGRAW

CONTACT INFORMATION (optional): thomasjmcgraw@gmail

Please leave this guide at the workstation where you picked up your clipboard. If you think of more to say later, please visit:

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<http://arlingtonreservoir.org/reservoir-master-plan/>

APPENDIX D

A Tour of the Arlington Reservoir



Arlington Reservoir Committee

Version 2 Spring 2003

THE ARLINGTON RESERVOIR

A greatly valued and much loved community resource.

*The initial motivation for this guide was the **Arlington Reservoir Art Project** – a collaborative effort between the Arlington Public Schools art program, the Arlington Center for the Arts (ACA) and the Arlington community, which took place in the fall of 2002.*

Through this program, the fifth grader students from several local schools explored the ecosystem of the Arlington Reservoir, as part of the art and science curriculum.

Wendy Campbell, art teacher in the Arlington Public Schools, was the primary organizer of this project. But many others volunteered and participated in numerous ways, including teachers, parents, grandparents, subject matter experts and other community members.

The Arlington Reservoir Art Project was funded by a grant from the Arlington Educational Enrichment Fund (AEEF), as well as by the Stratton and Bishop PTO's and library committees. Production of the booklet, "A Tour of the Arlington Reservoir," was funded by Arlington Vision 2020.

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The Arlington Reservoir

Many people in Arlington are familiar with the Reservoir or “the Res,” as it is also known. We can swim there in the summertime. But, the Res is much more than a swimming beach! Let’s explore the Res and the many different environments and issues that make it a very special place in our town.



Some Basic Facts

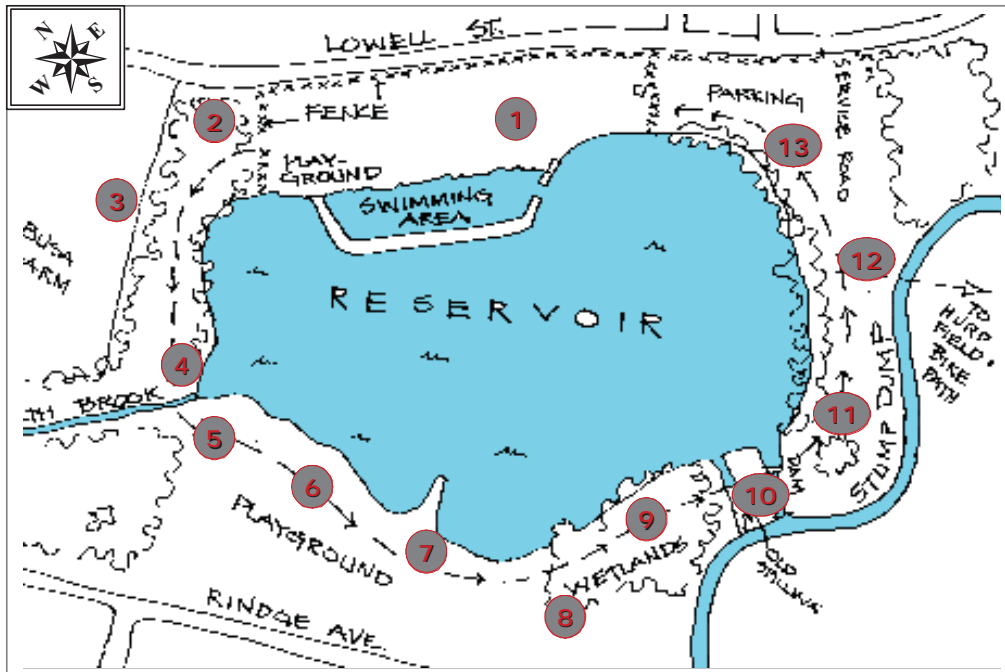
Did you know that...?

- *The actual swimming area is about 1½ acres, which is the size of almost 4 ice rinks.*
- *The total Reservoir water area is 28 acres, and that’s the size of almost 72 ice rinks or about 21 football fields (including the end zones).*
- *The water and land area around the Res, owned by Arlington, is 65 acres or a bit more than 49 football fields (about half of this is actually located in the town of Lexington).*

- *The watershed area draining into the Res is 1,120 acres (847 football fields!) and contains parts of both Arlington and Lexington.*
- *The Reservoir hasn't been used as a source of drinking water since the 1890's.*
- *The Res is part of the Mystic River watershed that drains into the Boston harbor.*
- *The Reservoir is a body of water that is actively managed by humans. Its depth is raised and lowered each season, and it is 6 feet higher in summer than the rest of the year. This helps to keep water in the swimming area.*
- *When the water is low, many mud flats are exposed and the deepest part of the Res near the dam is only 6 feet deep.*
- *The variation in the water level creates a very appealing habitat for a variety of birds in different seasons – nearly 150 species have been seen in the area!*
- *The Res acts as part of an avian flyway system. Migrating birds stop here on their way north in the spring and on their way back south again in the fall.*
- *Muskrats, turtles and several different kinds of fish, including Largemouth Bass and Bluegill, live in the Res.*

Let's Take a Walk Around!

The Arlington Reservoir is a place of great natural beauty. If you walk along the shoreline of the Res, you will find many habitats. Each of them is a special place with much to observe, as well as problems that we all need to understand and work to correct. Let's explore each of these areas and discuss some of the issues.



A Map of Our Tour

1. Reservoir Beach

Let's begin our tour at the beach itself. If you look around this area, you will see a space in nature that human beings have adapted for their use and needs. The beach area was first developed in 1935 and renovated to include the berm and water filtering equipment in 1983. Here you find a bathhouse, a playground, benches, picnic tables, a concrete walkway and handrail leading into the water, a berm that separates the swimming water from the rest of

the Res and equipment to clean and treat the water for swimmers. The berm is a favorite bird watching spot, after the beach is closed. The northern half of the beach is actually in Lexington.

Issues: You are probably most familiar with problems at the beach. Geese, ducks and dogs leave their droppings in the sand, grass, and water, making it very unpleasant for swimming and walking in bare feet. Ducks often try to steal your food when you picnic at the beach. People don't always use the trashcans, and the litter left behind is unattractive and can be hazardous. Chlorine is put into the swimming water to make it safe for swimming, and there is a filter to help keep the water clean, but it looks murky when bathers stir up the natural silt. Can you think of other problems that exist at the beach? Are there ways to correct these problems?

(Science Topics: Human impact on the environment, resource management, water chemistry, phosphorous cycle, & water quality testing)

2. Wooded area next to Lowell Street

As we walk out of the beach area, toward Lexington, we are following a trail that leads into a natural area of woods and brush. From the main walking trail, several trails lead uphill through the woods and out onto Lowell Street.

Issues: The woods near the road have been littered with trash that people have dumped there. Volunteers have helped to clean it out. Water run-off from the road has caused



erosion at the entrance to the trails. In this area, along Lowell Street, there are no or very poor sidewalks, making walking on Lowell Street unsafe. What ideas do you have for making this area better?

(Science Topics: Human impact, erosion, and infrastructure development)

3. Busa farmland



As the path that we are following turns to the left, you can see land that is used for farming, as it has been for many, many years. The Busa family owns this Lexington farmland, and after the fall harvest, many birds

like to gather in these fields to eat leftover seeds, other vegetation or insects.

Issues: Here the path can become overgrown by weeds, and tree roots are bare because of soil compaction and erosion. This can make walking difficult. In recent years, housing developers have been very interested in the farmland. Can you imagine how this area would change if houses were built on all or even some of the open space? What types of stress do buildings and pavement put on the environment?

(Science Topics: Erosion, human impact, and open space)

4. Munroe Brook area

Following further along the path, we see Munroe Brook, the major Reservoir water source. This area includes a path that goes about 1/4 mile



up the stream. It is a beautiful quiet natural area, and you can climb down along side the small arched bridge to watch the stream flow or water birds swimming and feeding.

Issues: The water that flows into the Reservoir here carries with it anything that flows into it from the roads, yards and fields upstream. Excess lawn and garden fertilizers, road salt and leaking oil are some of the contaminants that can pollute an urban watershed. Do you think people living upstream realize that what they do in their yards or on their streets can cause problems for the Res and the brooks?

(Science Topics: Human impact, watersheds, and water cycle)

5. More woods and marshy areas

Leaving the stream area, the path turns left and you are walking in a wooded area. The section on the left between the path and the Reservoir is marshland. Herons and other birds are known to hide among the taller grasses and cattails in this part of the Res.



Issues: Poison ivy grows in the overgrown areas beside the trail. Do you know how to recognize the poison ivy plant? Do you know what can happen if you touch the poison ivy plant? Watch out for it along other parts of the path, as well.

(Science Topics: Human interaction, plant defenses and adaptations)

6. Public park with grassy field

As you emerge from the woods, you find yourself in an open grassy space that's great for running around or spreading a blanket and enjoying a picnic. This is the

Rindge Avenue playground, located in Lexington. If you walk to the bench near the edge of the water, you will see a broken storm drain and soil erosion.

Issues: Most of the Reservoir water comes from Munroe Brook, but when it rains a lot of water from street drains also flows into the Res. This storm water can bring along a lot of trash and dirt from the streets. Is there anything that can be done to prevent this from happening?

(Science Topics: Water cycle, watershed and human impact)

7. Houses on an embankment & mud flats

Just beyond the park on the right of the path, houses are built on a slope overlooking the Res. What a lovely view! When the water level is low, the mudflats to the left attract certain types of birds, and visitors can walk out onto the peninsula opposite the beach area.

Issues: If you look out over the water in late spring and throughout the summer, you will likely see plants growing on the water. This is the invasive water chestnut weed, which is very bad for the Reservoir because it prevents sunlight from getting into the water and reduces the level of much-needed oxygen. And it isn't even considered good food by the



birds! You may have seen the seedpods that line the shore. They are dark and very hard with sharp spikes that really hurt if you step on them! The Arlington Conservation Commission hired a contractor with special harvesting machines to remove the weeds from the water. The machine works very well in the deep water, but can't reach the weeds that grow in the

shallow water near the shore. Last spring, a group of volunteers went out on the water in canoes and kayaks and pulled out lots of these weeds, and they will do it again next spring. We don't want water chestnuts in the Reservoir.

(Science Topics: Bioinvaders, seed cycle, seed adaptations, photosynthesis and co^2 - o^2 cycle)

8. Path along Sickle Brook

A little way up the main path, you can turn off to the right and follow another path. This leads into Lexington's Cataldo Reservation and follows along Sickle Brook, coming out near the bikeway. This is a place worth exploring sometime. It leads you into an area of very tall grass and next to a small pond. Sickle Brook flows from Arlington's Great Meadows, a natural area of 183 acres that is owned by the Town of Arlington but is located entirely in Lexington.

Issues: There is often a lot of trash at spots along this path. During heavy rains, a lot of water can flow down Sickle Brook into Mill Brook, causing flooding in Arlington. What kind of damage can a flood cause? Have you ever seen an area that was flooded?

(Science Topics: Human impact, watersheds, and water cycle)

9. Wetlands along Sickle Brook & Drake Village

We're going to follow along the main path. As you walk along this section of the path, you probably don't realize that you are actually walking on top of the Reservoir dam. To your left is the water and to your right are wetlands. The Drake Village housing complex



is located beyond the wetlands. This is a very peaceful walk with lovely trees and lots of greenery. It almost feels as though you are walking through a tunnel of trees, and if you're quiet you should be able to hear the birds singing.

Issues: For many decades, trees have been growing on the Reservoir dam. Since it is an earthen dam, trees and other vegetation growing on it anchor the soil and provide stability and erosion control. In recent times,

"No one knows yet exactly how many trees may be cut down."

however, engineers have decided that it isn't always safe for a dam to have trees growing on it. If a really huge storm, like a hurricane, were to knock over a tree growing on a dam then the roots might pull up, which would make a hole in the dam that water could flow through. Also, as trees die and their roots decompose, water can get into the dam and weaken it. So, while the dam at the Reservoir is safe today, the Town is trying to figure out how to keep it that way. This means that some of the trees and shrubs may be removed. But no one knows yet exactly how many trees may be cut down or what creative ideas there might be to make sure that the dam is kept safe while keeping the area wooded. Do you have any ideas for making this area attractive without using deep-rooted plants and trees?

(Science Topics: Human impact and resource management)

10. Dam gate for Res outflow & Mill Brook start

We're now going to cross the iron bridge that goes over the dam's emergency spillway. Water flows through here when the water in the Res gets too high. Just past the bridge is the regular spillway gate. We can stop and look at the big metal plate that is



raised to let water flow out, or lowered to hold water in the Reservoir. The water flowing out from the Res meets with the water flowing in Sickie Brook to form Mill Brook. Mill Brook flows all through the middle of Arlington and into the



Lower Mystic Lake at Meadowbrook Park, near the cemetery. By raising and lowering the plate at the spillway, the Town controls the level of the water in the Res to keep it higher in the summer and lower the rest of the year.

The Reservoir can be used to hold water during a big storm, which helps to reduce flooding downstream along Mill Brook. Are there other ways that you can think of to help reduce flooding downstream of the Reservoir in Mill Brook?

Issues: The spillway and gate areas are old and need to be modernized. There is a lot of work that needs to be done here and it will cost the Town a lot of money. Careful planning is being done to make sure that everything is fixed correctly.

(Science Topics: Human impact, resource management, water cycle, and watershed)

11. Stump dump area above Hurd Field

The "Stump Dump" is the wide area along the Res, as you walk past the dam spillway gate. You can see the ruts and tire marks made by the trucks that have driven in this area. Sometimes it's really muddy here. Mill Brook flows



along beside the “Dump,” opposite the Res, and you can look down at Hurd Field on the other side of the brook.

Issues: For many years, the Town used this area to dump soil and tree debris. In earlier years, coal ash was dumped here. People are still dumping trash into Mill Brook from the Hurd Field parking lot. Can you think of problems caused by dumping? The area is much wider now than it was originally because of all the dumping. In the last few years, the Town has stopped most of the dumping and has removed much of the old piles. It still looks very “dumpy”, but better than before. In the future, some trees and bushes may be planted here to make it more attractive.



(Science Topics: Human impact)

12. Roadway and side path to Hurd Field

After passing the stump dump area on the main roadway, there is a path that goes off sharply to the right. This path crosses over Mill Brook and leads to Hurd Field and the Minuteman Bikeway. Further along on the left are several good spots for climbing down to the water for fishing and bird watching.

Issues: The ground here is covered with gravel and not much grows here. However, on the side away from the water is a thick growth of invasive Japanese Knotweed that has strangled out other plants. What are some ways to get rid of invasive plants? This area is also part of the dam and some trees may have to be removed.

(Science Topics: Bioinvaders)

13. Parking area for the beach

Now, here we are back at the beach parking lot! When we reach the gate to the beach, we will have completed a 1-mile walk. Did you ever think that there was so much to see in a 1-mile walk so close to home?

Issues: During heavy rains, the water will wash whatever is in the parking area into the Res. This may include trash or oil that has dripped from cars.

(Science Topics: Watersheds, water cycle, erosion, and soil)

Reservoir Goals & Committee



The Reservoir area needs thoughtful oversight and vision, so that the many residents, both old and young, who enjoy it will continue to do so for many generations. To help safeguard this space, on Monday, May 6, 2002 Arlington's Town Meeting approved the following Selectmen's recommendation:

That the Town hereby endorses the goals for the Arlington Reservoir area as recommended by the Reservoir Committee of the Vision 2020 Environmental Task Group and Vision 2020 Standing Committee, calculated to protect the ecosystem of the Arlington Reservoir area. In particular, the Town supports the following goals for the Arlington Reservoir and its role within the Mystic River Watershed:

1. **Water Quality:** To attain and maintain, in an ecologically sensitive manner, the appropriate water quality standard.
2. **Water Management:** To manage the Reservoir and its drainage to minimize downstream flooding, support wildlife habitat, and allow recreational uses.
3. **Flora and Fauna:** To protect and enhance the health and diversity of native plants and wildlife consistent with protecting public safety and recreational uses.
4. **Public Use and Open Space:** To promote and enhance public access for passive and active recreational uses while maintaining and protecting the unique natural setting of the Reservoir.
5. **Public Awareness:** To enhance awareness of the ecological, economic, recreational, and esthetic values of the Arlington Reservoir and its setting.

Vision 2020's Arlington Reservoir Committee is a group of concerned citizens working to implement these goals and solve the Reservoir's problems. Monthly meetings are held to discuss projects, news and priorities. These meetings are advertised in *The Arlington Advocate* and on the town's website calendar. Anyone with an interest in the Reservoir is welcome and encouraged to attend or to join us at one of the special clean-up events generally held in spring and fall.

Birds at the Arlington Reservoir

Swimmers:

Pied-billed Grebe
Double-crested Cormorant
Great Cormorant
Mute Swan
Canada Goose
Brant
Greater White-fronted Goose
Mallard
American Black Duck
Gadwall
Common (Northern) Pintail
Green-winged Teal
Blue-winged Teal
Northern Shoveler
Eurasian Wigeon
American Wigeon

Wood Duck
Redhead
Ring-necked Duck
Canvasback
Greater Scaup
Common Goldeneye
Bufflehead
Ruddy Duck
Hooded Merganser
Common Merganser
Red-breasted Merganser
American Coot
Great Black-backed Gull
Herring Gull
Ring-billed Gull

30 swimmers

Nonswimmers:

Great Blue Heron
Green Heron
Great Egret
Black-crowned Night Heron
Lesser (American) Golden Plover
Semipalmated Plover
Killdeer
Greater Yellowlegs
Lesser Yellowlegs
Solitary Sandpiper
Spotted Sandpiper
Hudsonian Godwit
Semipalmated Sandpiper
Western Sandpiper
Least Sandpiper
White-rumped Sandpiper

Pectoral Sandpiper
Common Snipe
Turkey Vulture
Sharp-shinned Hawk
Red-shouldered Hawk
Broad-winged Hawk
Red-tailed Hawk
Osprey
Merlin
American Kestrel
Rock Dove
Mourning Dove
Common Nighthawk
Chimney Swift
Belted Kingfisher
Ruby-throated Hummingbird

Northern Flicker
Yellow-bellied Sapsucker
Downy Woodpecker
Hairy Woodpecker
Eastern Kingbird
Willow Flycatcher
Eastern Phoebe
Great Crested Flycatcher
Purple Martin
Tree Swallow
Northern Rough-winged Swallow
Bank Swallow
Barn Swallow
Blue Jay
Common (American) Crow
Black-capped Chickadee
Tufted Titmouse
White-breasted Nuthatch
Brown Creeper
Carolina Wren
House Wren
Northern Mockingbird
Gray Catbird
American Robin
Ruby-crowned Kinglet
Golden-crowned Kinglet
Cedar Waxwing
Brown Thrasher
European Starling
American Pipit
Warbling Vireo
Red-eyed Vireo
Nashville Warbler
Black-and-white Warbler
Northern Parula
Yellow Warbler
Magnolia Warbler
Black-throated Green Warbler

Blackburnian Warbler
Yellow-rumped Warbler
Chestnut-sided Warbler
Blackpoll Warbler
Palm Warbler
Northern Waterthrush
Common Yellowthroat
American Redstart
Red-winged Blackbird
Rusty Blackbird
Orchard Oriole
Baltimore Oriole
Common Grackle
Brown-headed Cowbird
Scarlet Tanager
Northern Cardinal
Rose-breasted Grosbeak
Blue Grosbeak
Indigo Bunting
House Finch
American Goldfinch
Savannah Sparrow
Northern (Dark-eyed) Junco
Snow Bunting
American Tree Sparrow
Chipping Sparrow
Field Sparrow
Vesper Sparrow
White-throated Sparrow
Swamp Sparrow
Song Sparrow
Lincoln's Sparrow
House Sparrow

103 nonswimmers

Thanks for joining us on our tour of the Res today! We hope you enjoyed it and learned some new things. For more about the Arlington Reservoir, you can visit the Arlington Reservoir website. This website has information about the Reservoir and about what the Reservoir Committee is doing to help protect and preserve it.



A Proud Past, A Focused Future

Visit us on the Web!

www.arlington2020.org/reservoir/



Cover art mural of the Reservoir done by Wendy Campbell's Bishop School students

APPENDIX E

10 January 2018

Updated Notes on the Importance of Arlington Reservoir to Birds and to the Arlington Community.

Karsten E. Hartel

I thought it would be helpful to update some comments that I made in 1999 about birds and birders at the Arlington Reservoir. At that time, I was Chair of the Arlington Vision 2020 Open Space Committee. The remarks included a list of about 150 species of birds known at that time from the Reservoir, comments from regional people, and a summary of the number of “birding” visits to the reservoir. A copy of that report follows below.

Since that time, more is known about which bird species that frequent the Reservoir, Cataldo Trail, and the abutting Lexington Community Farm. These abutting open spaces magnify the natural importance of the Reservoir. The new information has been gathered by a Cornell University Program called e-Bird which compiles, reviews, and digitally publishes bird occurrence information submitted by birders from around the world. To date, based on the eBird data we know that 214 species of birds have been recorded around the Reservoir. These data are based on some 1,858 observations submitted to e-Bird (see links below). Some of the reported species are common to abundant but some species are rare and are known from only a few records. I am not including a 2018 bird list since the e-Bird list can be found easily on the web at <http://ebird.org/ebird/hotspot/L358557>.

The comments in the 1999 report also document the importance of the reservoir to people who enjoy natural history based comments and the number of trips to the Reservoir in 1999.

Based on these notes I can say, as I wrote in 1999, that “There are no other habitats quite like these elsewhere in Arlington.” To keep this, all habitat types must be considered including, in part, shallow and deep water, mudflats, aquatic vegetation and scheduled adjustment of water levels.

About eBird: <http://ebird.org/content/ebird/about/>
eBird data for Arlington Reservoir: at <http://ebird.org/ebird/hotspot/L358557>
eBird seasonal occurrence chart for the Reservoir: at
<http://ebird.org/ebird/barchart?r=L358557&yr=all&m=>

Citation: eBird. 2012. eBird: An online database of bird distribution and abundance [web application]. eBird, Ithaca, New York. Available: <http://www.ebird.org>. (Accessed: Date January, 2018)].

Birds and Birders at the Arlington Reservoir.

By

Karsten E. Hartel¹

22 April 1999

With some edits in 2018 (KEH)

This report is presented to establish baseline data on important aspects of the Arlington Reservoir; namely, the great abundance and diversity of bird life that can be seen in the area and use of the site by birders. This report is written to document the value of the site in these regards.

The Town of Arlington owns the Reservoir and all the immediate land surrounding it, including an extension along Munroe Brook. The area is under the management umbrella of the Arlington Public Works Department. The Arlington Park and Recreation Commission has jurisdiction over the swimming area. Since the Reservoir is situated in both Arlington and Lexington, its wetland status is under the jurisdiction of both Arlington and Lexington Conservation Commissions. The ecology and public use of the area points out the need for a comprehensive management plan for the area. Indeed, goals in that plan could well include enhancement of the area for wildlife.

BIRDS

The Arlington Reservoir is an important migratory area for many waterbirds and the surrounding uplands provide fair to good habitat for songbirds. Nearly 150 species of birds have been seen in the immediate area (see a full list in Appendix 1). The habitat is probably the "wildest" in Arlington and its diversity attracts the birds even though the Reservoir was artificially created.

The seasonal fluctuation in water level creates good three seasons of spectacular birds. It draws diving ducks and grebes (in the deep end) and dabbling ducks, shorebirds and herons around the weeds and mudflats (shallow end). There are no other habitats quite like these elsewhere in Arlington. At times the Reservoir draws a wider variety of waterfowl than the Great Meadows National Wildlife Refuge in Concord.

BIRDING

¹ K.E. Hartel is Chair of the Arlington Open Space Committee and Co-chair of the Vision 2020 Spy Pond Subcommittee

Over the last ten years, birding, or in other words observing wild birds for enjoyment, has grown immensely in popularity. A recent survey shows that there are an estimated 54 million participants in this endeavor in the United States. This survey also shows that birding is participated in by more people than such traditional outdoor activities such as hiking and camping. The number of people fishing or bicycling only exceeds the number birding by three to four million participants.

In April of 1999, a survey of subscribers to local bird list-servers were asked how often they visited the Reservoir between Spring 1998 and Spring 1999. The responses (Appendix 2) show that the 76 birders spent 1060 birder visits to the Reservoir. The respondents (and the people who might have been with them) probably represent only a small portion of the birders visiting the Reservoir. Expanding the sub-sample to a total estimate is difficult, but a few thousand day-visits is not out of the question over a period of a year. Surely this outnumbers the fisherpeople and maybe even the recreational walkers using the area.

Birders are very appreciative of the opportunities at the Reservoir and make the following comments:

- ❑ "Reservoir is very a very significant site for ease of waterfowl & shorebird observation. The site is exceptional for waterfowl variety." **Geoffrey Wood, Newbury**
- ❑ "I think Arlington Res is one of the birding gems of our local area." **Albert Young, Medford**
- ❑ "I've been birding at the Res for about 5 years & think that it has gone from very good to excellent for migratory-duck-watching. This past year has been the best ever. I am a little worried about the problems of growing populations of Canada geese, mute swans and water chestnuts. It would also be nice if the trash & broken glass could be reduced but it's clearly a teen hangout, so I am resigned to their detritus to some degree" **Jennie Rathbun, Arlington**
- ❑ "I like the Res, and get the impression that most everyone who uses it also likes it... I hope that any "improvements" would not have a negative impact on the value of the Res as a migratory resting stop for birds, as well as a breeding spot for resident birds. One relatively easy improvement I would like to see would be a couple of strategically placed signs asking dog owners to please use pooper scoopers. It's a popular dog-walking area, and not everyone is responsible along those lines." **Sam Miller and Carla Dengler, Arlington**
- ❑ "Arlington Reservoir was one of my first birding discoveries ten years ago, and it has been one of my favorite spots ever since. I look forward every spring and fall to the lowering of the water which means an incredible influx of water birds into this area. The variety of ducks than can be seen there is unmatched in any other pond I know of, probably because there is a "deep end" for diving ducks and a "shallow end" for dabbling ducks. This exposure of the mudflats is a big attraction for shorebirds. There is no question that the Res. is an important stopover for huge quantities of birds, but just as important is the pleasure it brings so many people. Birders come here from all over the greater Boston area. I've often run into friends there, and even made new friends. Just Wednesday I ran into two women I didn't know, and introduced myself. I set up my telescope for them so they could enjoy the snipe feeding by the shore, and later showed them the incredible plumage on a Ruddy Duck. While we were admiring, a dog walker walked by and we showed her, too. She was thrilled to discover that there were several different types of ducks - until she had a chance to look, she had assumed they were all the same. It is this last anecdote that typifies so many of my experiences at the Res. Every time I walk around I run into kids playing, people exercising, dog walkers, or people just enjoying being outside. I cannot count the times we have paused to talk, and I have shown people what is out there.

They are always thrilled." **Marjorie Rines, Arlington** Marj Rines is an editor of the *Bird Observer of Eastern Massachusetts* (<http://people.ne.mediaone.net/marjrines/BirdObserver.htm>) and a member of the Massachusetts Avian Records Committee. She also co-authored the chapters on finding birds in the Boston area in *A Birder's Guide to Eastern Massachusetts*.

- ❑ "As far as I'm concerned, the Res is a much more valuable place to me as an adult going birding than it ever was when I was a kid going swimming, and I go there *much* more often than I did in those long-ago days. It's an absolute marvel to have a place so near that's so full of a wonderful variety of migrating ducks and shorebirds, and the edges and trees so full of dickey-birds. You just never know what you'll find there on any given day. The place is just right when you have an hour's break for a little birding close to home. As far as I'm concerned, it's just fine the way it is, if they can keep the water chestnut problem under control without decimating the area moving equipment in and out or poisoning things in some other way. Outside the height of the summer season, it seems to me that it accommodates a whole variety of uses very nicely and without conflict-- folks walking dogs, folks with kids, people like me with binos, just plain walkers. " **Jane Stein, Arlington**
- ❑ "There are very few spots in Arlington as "wild" as the Res, and it would be nice to see its potential for wildlife and wildlife watching enhanced. There is much to be said for a place that you can get to know well, visit on a regular basis, and observe the changes from season to season and year to year. In an urban area such as ours, these places are treasures." **Andrea Golden, Arlington**
- ❑ "In my opinion the reservoir is the best duck place in the state. Where else can one go and see good close views of Northern Shovelers, Blue Winged Teal, Canvasbacks, and a Redhead along with many other duck species all at the same time?" **Halina Raymond, Roslindale**
- ❑ "I love birding at the Res. I like the fact that almost everything that is there is within view, instead of a lot of territory being out of reach or off limits like other birding spots. I also photograph birds (and nature) and have taken some of my favorite pictures at the Res. It was nice having that tame Pintail around this past fall. Also, because it's not very big, it's a place where I often stop and really observe bird behavior (like the Kingfisher I watched in Nov. that was catching fish much too big and smashing them over & over against a branch. It was also great this past fall to have the Canvasback & Redhead in the same view for comparison (and without having to look through a fence). I'd also like to mention that I've gotten more than one life bird there." **Dianne Hartman, Somerville**
- ❑ "I am a residence of Arlington; my husband and I own the property at 26 Lombard Rd. We and our 16yr.old son have lived at that address for 2 yrs. in August. We all bird the Arlington "Res", Spring and Fall and recognize its primary importance as a migratory trap much like Mt Auburn Cemetery in Cambridge. The Arlington Reservoir is regularly mentioned on the Eastern Voice of Audubon as a location of important and often rare bird species especially migrating waterfowl and is known as such by the larger Boston birding community-and even state-wide. When relocating from western Mass. two years ago our family looked for a location that was convenient to urban Boston yet had some elements of nature and birding "hotspots". Arlington, with the Arlington "Res" and its proximity to other "natural areas" such as Great Meadows, fit the bill. Spy Pond is great but doesn't compare to the diversity of habitats and bird species that the "Res" supports. Yesterday, by coincidence, I began my Spring ritual of biking to and from the "Res" in the morning before work, binoculars hanging from my neck. I saw ruddy ducks, ring-necked ducks and a killdeer. I didn't have time to make my way around the perimeter as I do on most trips but still, it made my day." **Sharon Dombeck, Arlington**
- ❑ "My wife and I take a walk around the Res about once a month year round; we almost always have our binocs with us and enjoy the wildlife; we are beginner birders who live in Arlington. We saw our first osprey at the Res 3 years ago; it came swooping in from the west; we got really good looks at it; it spotted something below the water and, to our surprise, plunged headfirst from about 2 feet and disappeared for a moment, then came up empty. Some years ago, the Res was responsible for teaching me that all ducks are NOT mallards, you know the ones who beg for handouts at the beach when you are trying to watch your food and kids. I started noticing that some were beautifully different and this

stimulated me to get a field guide to figure out what I was looking at. I think it is fair to say that my wife and I have seen ten waterfowl species for the first time at the Res, not to mention the big snapping turtles and muskrats and assorted songbirds." **Tom Christensen, Arlington**

- "I am an Arlington resident and am VERY concerned about the ecology of the Res and its value as habitat. (In fact I recently wrote a letter to the Advocate about the Water Chestnuts, trying to explain that their presence is not only an aesthetic problem.). The Res is an important asset to the town, in my view. We love to swim there, but more importantly I treasure my walks there year-round, among the birds and other wildlife. We have so little open space in Arlington that I would like to see the Res managed as a multi-use resource, INCLUDING maintaining the marsh/wet land ecology that supports so many species, not just focusing on it as a beach. As far as how I see the Res, I would note that currently, the area to the left of the beach (on the road from the parking lot) is looking unattractive. There are piles of gravel and logs. It looks like a place in transition, but to what is unclear. This area could certainly be improved. The rest of the circuit is very nice, although the run off area seems rickety." **Ellen Duranceau, Arlington**

Appendix 1

Birds Known from Arlington Reservoir (1999)

Pied-billed Grebe	American Woodcock	Northern Waterthrush
Double-crested Cormorant	Ring-billed Gull	Common Yellowthroat
American Bittern	Herring Gull	Wilson's Warbler
Great Blue Heron	Iceland Gull	Scarlet Tanager
Great Egret	Great Black-backed Gull	Northern Cardinal
Green Heron	Forster's Tern	Rose-breasted Grosbeak
Black-crowned Night-Heron	Rock Dove	Blue Grosbeak
Mute Swan	Mourning Dove	Indigo Bunting
Snow Goose	Common Nighthawk	Eastern Towhee
Canada Goose	Chimney Swift	American Tree Sparrow
Greater White-fronted Goose	Ruby-throated Hummingbird	Chipping Sparrow
Wood Duck	Belted Kingfisher	Field Sparrow
Green-winged Teal	Yellow-bellied Sapsucker	Vesper Sparrow
American Black	Downy Woodpecker	Savannah Sparrow
Mallard	Hairy Woodpecker	Fox Sparrow
Northern Pintail	Northern Flicker	Song Sparrow
Blue-winged Teal	Willow Flycatcher	Lincoln's Sparrow
Northern Shoveler	Eastern Phoebe	Swamp Sparrow
Gadwall	Great Crested Flycatcher	White-throated Sparrow
Eurasian Widgeon	Eastern Kingbird	White-crowned Sparrow
American Widgeon	Purple Martin	Dark-eyed Junco
Canvasback	Tree Swallow	Red-winged Blackbird
Redhead	No. Rough-winged Swallow	Rusty Blackbird
Ring-necked Duck	Bank Swallow	Common Grackle
Greater Scaup	Cliff Swallow	Brown-headed Cowbird
Lesser Scaup	Barn Swallow	Orchard Oriole
Common Goldeneye	Blue Jay	Baltimore Oriole
Bufflehead	American Crow	House Finch
Hooded Merganser	Black-capped Chickadee	American Goldfinch
Common Merganser	Tufted Titmouse	House Sparrow
Red-breasted Merganser	White-breasted Nuthatch	
Ruddy Duck	Brown Creeper	
Turkey Vulture	Carolina Wren	
Osprey	House Wren	
Sharp-shinned Hawk	Golden-crowned Kinglet	
Cooper's Hawk	Ruby-crowned Kinglet	
Red-shouldered Hawk	American Robin	
Broad-winged Hawk	Grey Catbird	
Red-tailed Hawk	Northern Mockingbird	
American Kestrel	Brown Thrasher	
Merlin	American Pipit	
Ruffed Grouse	Cedar Waxwing	
American Coot	European Starling	
Lesser Golden Plover	Blue-headed Vireo	
Semipalmated Plover	Warbling Vireo	
Killdeer	Red-eyed Vireo	
Greater Yellowlegs	Nashville Warbler	
Lesser Yellowlegs	Northern Parula	
Solitary Sandpiper	Yellow Warbler	
Spotted Sandpiper	Chestnut-sided Warbler	
Hudsonian Godwit	Magnolia Warbler	
Sanderling	Black-throated Blue Warbler	
Semipalmated Sandpiper	Yellow-rumped Warbler	
Western Sandpiper	Black-throated Green Warbler	
Least Sandpiper	Blackburnian Warbler	
White-rumped Sandpiper	Palm Warbler	
Pectoral Sandpiper	Blackpoll Warbler	
Dunlin	Black-and-white Warbler	
Common Snipe	American Redstart	

Appendix 2

Birding visits to Arlington Reservoir between Spring 1998 and Spring 1999 based on e-mail survey conducted in April 1999. Column 2 reports the number of visits, Column 3 the number of individuals, and Column 4 the birder visits.

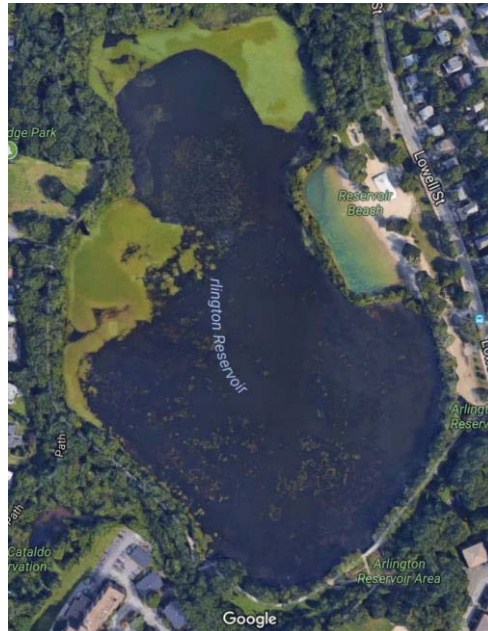
Anon., (Y., A.)	6	1	6	Medford
Barney, K.	25	1.5	37.5	Cambridge
Bird Walks- Hartel 1998	2	10	20	Arlington
Bird Walks- Hartel 1999	2	9	18	Arlington
Bragg, A.	5	1	5	Bedford
Cooper, D.	16	1	16	Medford
Cronenweth, S.	50	1	50	Arlington
Dengler, C.	13	1	13	Arlington
Dombeck, S.	115	3	345	Arlington
Dorsey, K.	6	1	6	Arlington
Duranceau, E.	12	1.7	20	Arlington
Epstein, M.L.	15	1	1	Medford
Faherty, B.	2	1	2	Brockton
Faherty, M.	2	1	2	Brockton
Ferraresso, L.	7	1	7	Watertown
Finnegan, G.	2	1	2	Cambridge
Forbes, J.	4	3	12	Waltham
Golden, A.	5	2	8	Arlington
Hartel, J.A.	6	1	6	Arlington
Hartel, K.E.	30	1	30	Arlington
Hartman, D.	24	1	24	Somerville
Hedman, S.	3	1	3	Manchester
Kuerzel, R.	1	1	1	Longmeadow
LaFontaine, R.	16	1	16	Medford
Larson, D.	7	1	7	Stoughton
Larson, S.	2	1	2	Stoughton
Leka, L.S.	4	1	4	Cambridge
Levandoski, G.	2	1	2	Brockton
Mara, T.	50	1	50	Arlington
Miller, S.	15	1.1	17	Arlington
Moore, S.	8	1	8	Northboro
Oliver, David	12	1	12	Arlington
Oliver, Dennis	12	1	12	Medford
Plimpton, O.	9	1	9	Arlington
Plimpton, P.	4	1	4	Arlington
Rathbun, J.	30	2	60	Arlington
Raymond, H.	3	2	6	Roslindale
Rines, M.	60	1	60	Arlington
Roberts, J.	20	1	20	Medford
Roberts, P.	25	1	25	Medford
Stein, J.	40	1	40	Arlington
Stevens, B.	7	1	7	Cambridge
Vale, F.	7	1	7	Wakefield
Vale, P.	7	1	7	Wakefield
Volkle, B.	4	1	4	Northboro
Wood, G.	3	1	3	Newbury
Wright, B.	5	1	5	Arlington
Wright, J.	2	1	2	Arlington
Zendeh, S. & family	12	3	36	Lexington
		76.3	1059.5	

APPENDIX F



Year-End Report for the 2017 Management of: **Arlington Reservoir**

Arlington, MA



Submitted: January 18, 2018

SOLitude Lake Management
590 Lake Street
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2017 Mechanical Operations

SOLitude was requested to conduct an aquatic harvesting program in 2017 to control the water chestnut infestation along Arlington Reservoir. SOLitude, previously Aquatic Control Technology has been incorporated in these management efforts for over 15 years. The overarching objective of this mechanical management program is to continually decrease the water chestnut infestation within the Reservoir due to its invasive nature.

Prior to mechanical operations, SOLitude mobilized the power washed 'weed free' H5-130 harvester and steel containment tub at the established shoreline entry site, located in the southeastern section of the pond. The staging area was then prepared by Arlington's DPW in which the front-end loader with backhoe was mobilized at the associated off-loading area.

The harvesting operation began on September 5th, and ran for a total of eight days. During operations the collected water chestnut was mechanically removed by the harvester and placed into the containment tub. Once full, DPW collected the material from the tub with the front-end loader and placed it into a dump truck. The material was then transported to a proper disposal facility. Please refer to **Figure 1** for a map of the harvested areas.

The mechanical management program concluded on Friday September 15th, 2017. At this time the equipment/staging material was removed and the grounds were groomed.

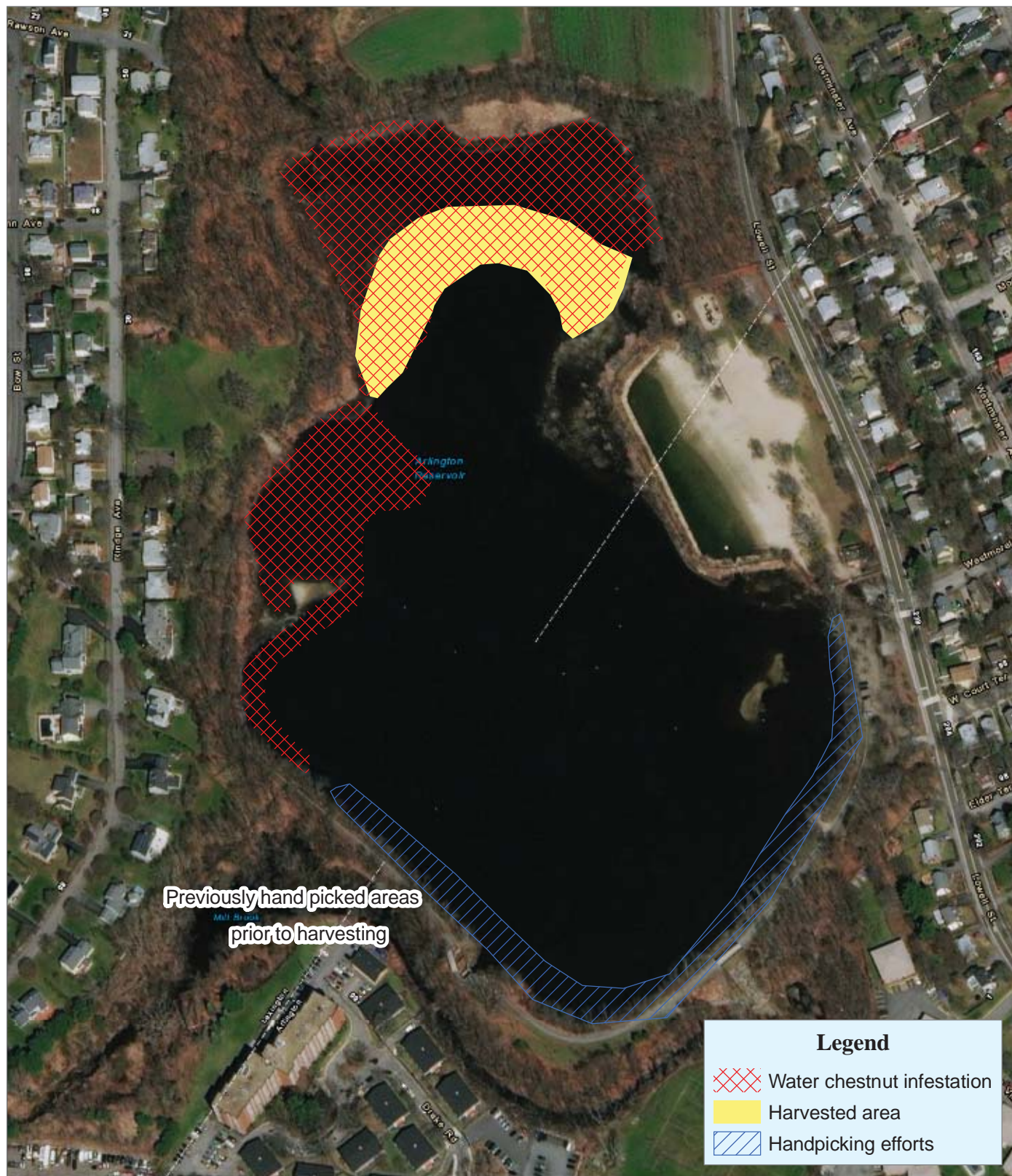
In addition, it was observed that volunteer hand picking efforts were conducted in July and during the last two days of mechanical harvesting. During the September volunteer hand removal efforts, the hand pullers focused on the northern cove where the harvester was present. All of the collected water chestnut was placed on the conveyor of the harvester, and brought to the designated off-load area for disposal. Please refer to **Image 1** for a photo of the pile collected from the July hand picking efforts, this pile came from the blue area shown in the southern section of the Reservoir on the attached map.



Image 1: Collected water chestnut, Taken August 3rd, 2017

Overall, the 2017 management program ran smoothly controlling about 2 of the 5-acre infestation to the north. Unfortunately, the entire management area was not controlled due to the allotted budget. The more days we can allot to this area, the higher amount of control will be achieved. Looking ahead to 2018, SOLitude would recommend a similar management program with increased management days if possible. Please feel free to contact us regarding any questions or additional information.

Figure 1: Map of *Trapa natans* infestation and Harvesting Efforts



Arlington Reservoir
Arlington, MA



Data Collected: 09/15/2017
For: Arlington, MA
Basemap © 2013 Esri

0 200 400
1:3,080 Feet



SOLITUDE
LAKE MANAGEMENT

APPENDIX G

ARLINGTON PONDS

2007 BASELINE SURVEY

Report Based on Vegetation Surveys and Water Quality Sampling
Performed at:
Arlington Reservoir, Menotomy Rocks Pond and Spy Pond in 2007

December 2007

Prepared for:
Town of Arlington
Department of Public Works
730 Massachusetts Avenue



Prepared by:



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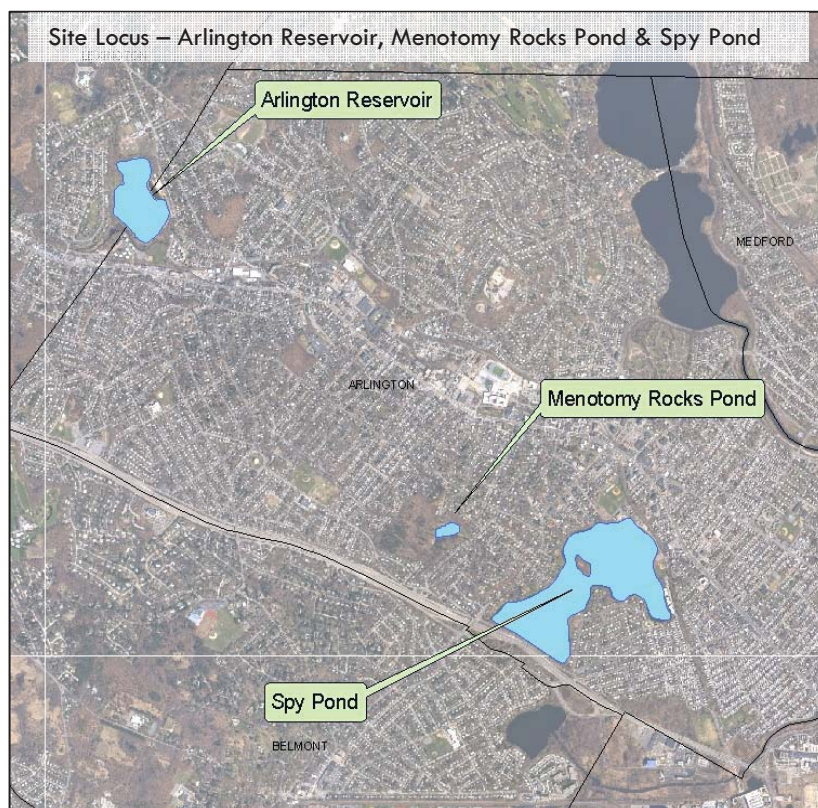
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INTRODUCTION

In the summer of 2007 Aquatic Control Technology, Inc. (ACT) was contracted by the Town of Arlington to conduct comprehensive aquatic plant surveys at three waterbodies: Arlington Reservoir, Menotomy Rocks Pond and Spy Pond. At each waterbody, qualitative Mid-Season Vegetation Surveys and quantitative Late Season Data Point Intercept Surveys were conducted. During each survey Secchi Disk Transparency readings and Temperature/ Dissolved Oxygen Profiles were recorded. A water sample was also collected at each waterbody and tested for a suite of basic water quality parameters by a State Certified Laboratory.

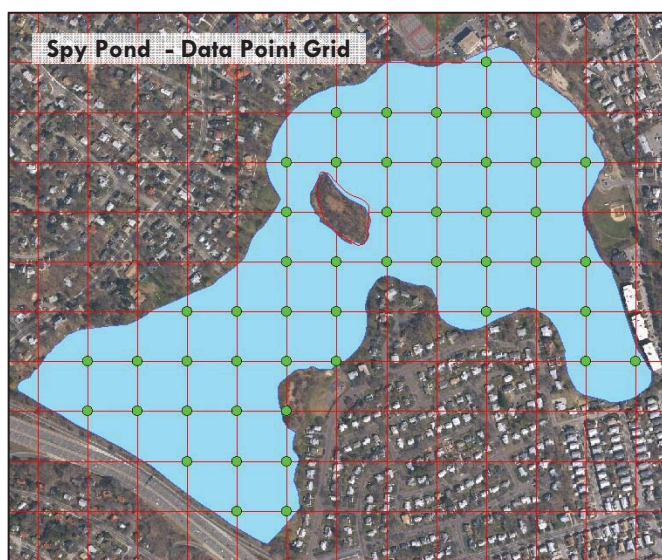
The 2007 survey work was conducted to:

- Establish quantitative baseline information regarding the aquatic macrophyte community at each of the surveyed waterbodies
- Produce detailed maps showing the distribution for each aquatic plant species observed.
- Create and provide a template(s) from which future vegetation surveys can be performed and replicated at each of the waterbodies to allow for long-term vegetation monitoring
- Document and analyze baseline water quality information
- Provide the Town of Arlington with site specific management recommendations for each of the surveyed waterbodies



AQUATIC VEGETATION SURVEYS

Although qualitative vegetation surveys were conducted at Arlington Reservoir, Menotomy Rocks Pond, and Spy Pond at the end of July (7/31/07), the balance of this report will focus primarily on the quantitative vegetation data collected during the Late Season Data Point Surveys. Information gained from the precursory qualitative surveys will however be considered with regards to management recommendations and in discussion of water quality parameters. Marked shifts in vegetative cover between the two survey dates will also be discussed where applicable.



Methodology

On August 31st and September 4th, Aquatic Control Technology, Inc. conducted Data Point Intercept Surveys at Arlington Reservoir, Menotomy Rocks Pond and Spy Pond. The methodology for each of the surveys was derived from the point intercept sampling method developed by the U.S. Army Corps of Engineers (Madsen 1999). The point intercept method is intended to document the spatial distribution, percent cover and biomass of each aquatic macrophyte species at specific re-locatable data point sites.

Using ArcView 9.1 software, point intercept data points were created at the vertices of individually tailored sample grids. Each of the grids was created prior to the field work and was sized according to waterbody area and the anticipated frequency of data points needed to establish a “reasonable” data collection set (see picture above). Frequency of the point intercept data points varied between reservoirs from ~5.5 data points per acre at Menotomy Rocks to ~0.5 data points per acre at Spy Pond.

Data points were navigated to by boat using a Garmin 76Cx GPS unit. At each data point, vegetation was identified and quantified using a combination of a vegetation “throw rake”, an underwater AquaVu camera system and visual inspection. For each data point, areal coverage estimates (density) of each species encountered were recorded and an overall biomass estimate was assigned based on the relative volume of each plant community. The biomass index is representative of the overall height of plants in the vicinity of the sample point. The index ranges from 0-4 according to the following breakdown: 0 – No plants, 1 – plants generally low-growing within a foot of the bottom, 2 – plants generally half-way through the water column, 3 – plants within 1-2 feet of the surface, 4 – plants just below or at the surface.

Water depth was recorded using a calibrated sounding rod for depths less than 15 feet and a high-resolution fish finder (Lowrance LC X15mt) for depths in excess of 15 feet (Spy Pond only).

Sediment type was also recorded at each data point where reasonable sediment determinations could be made.

Particular attention was paid to the presence of any non-native plant species, which may have a higher probability of degrading water quality. Dense vegetation, especially consisting of non-native species can negatively impact water quality in a number of ways:

- **reduce open water habitat**
- **impact fish populations and growth trends**
- **reduce predator/prey interaction**
- **create potentially harmful dissolved oxygen fluctuations**
- **increase water temperature**
- **limit access to the pond for recreation**
- **negatively impact shoreline property values**

As aquatic vegetation plays a large role in the waterbody ecosystem, these surveys are an important component in the overall lake and pond management plans.

Results

The following section of the report presents and discusses the data collected during the 2007 survey work. Some relevant tables and figures are found embedded in the text, however, more detailed maps and data point specific survey information can be found in the appendices attached to the end of the report.

Arlington Reservoir

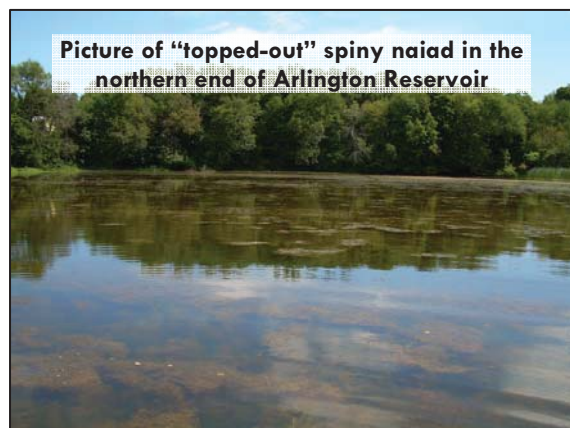
Arlington Reservoir a 28 acre waterbody located on the Arlington/Lexington line was surveyed on 7/31 & 9/4/07. The Data Point Intercept survey performed in September included 34 data collection sites, creating a data point frequency of approximately 1.2 points/acre.

The average recorded water depth of the reservoir was approximately 5.1 feet with a maximum recorded depth just over 7.5 feet. The substrate composition throughout the majority of the waterbody was generally mucky with patches of sand and gravel. In general the muck appeared to be only a few inches to a foot thick, however, some areas of the Reservoir harbored significantly greater buildup of sediment, most notably the shallower northern cove, where accumulation of sediment is evident along the shoreline to the south of the inlet. In general, however, immediate shoreline areas elsewhere in the waterbody exhibited significantly less accumulation of organic muck and were generally characterized by a sandier, rockier bottom substrate.

Table 1

Arlington Reservoir – Summary of Survey Results

Surface Area	28-acres
Average Depth	5.1-feet
Maximum Recorded Depth	7.5-feet
# of Survey Points	34
# of Survey Points/acre	1.2
Overall Plant Cover	74%
Overall Plant Biomass	~2.8
Dominant Species	Coontail Eurasian milfoil (exotic) Najas minor (exotic)



The water clarity at the Reservoir was generally poor, averaging 3.7 feet between the two surveys (4.3 ft. – 7/31 & 3.1 ft. – 9/4/07). Dissolved oxygen levels were high throughout season averaging nearly 110% oxygen saturation through the first through the first five feet of water (9.69 mg/L at 26.9°C on 7/31 & 8.52 mg/L at 23.3°C on 9/4/07). The elevated oxygen saturation recorded in Arlington Reservoir is indicative of a waterbody with dense cover of aquatic plant growth. Algae counts were low in Arlington Reservoir but were primarily dominated by *Microcystis* a common blue-green algae which accounted for nearly 1/2 (2,960 of 6,253) of the cells counted.

Although 11 different aquatic plant species were identified during the course of the 2007 Vegetation Survey, the collective vegetation assemblage was dominated by coontail (*Ceratophyllum demersum*), Spiny naiad (*Najas minor*) and Eurasian watermilfoil (*Myriophyllum spicatum*). Of the 34 data points (91% of the data point locations) where vegetation was encountered, coontail was found at 79% of these points; Eurasian watermilfoil at 77%; and spiny naiad at 62%. The average depth of these points was slightly less than 5 feet. The overall biomass at the vegetated sites was high, averaging approximately ~3.25, which was due in large part to the expanse of “topped-out” spiny naiad in the shallow northern third of the Reservoir, and the thick band of “topped-out” coontail growth around much of the reservoir’s Southern and southern shoreline. Other smaller areas of “topped-out” thinleaf pondweed and Eurasian water milfoil were also encountered. The average areal density across the 31 vegetated data points was also high with an average of over 80%. (See Appendix A - Figure 3 - Vegetation Assemblage Map)



Growth of floating leaf plants including: white waterlily (*Nymphaea odorata*), watershield (*Brasenia schreberi*), water chestnut (*Trapa natans*) and variegated water clover (*Marsilea mutica*) was recorded during each of the surveys at Arlington Reservoir. In large part growth of these plants was confined to the northern 1/3 of the Reservoir. Although there were some sizable beds of watershield and water clover along the shoreline of the reservoir, cover of waterlily and water chestnut was widely scattered and patchy.

While Eurasian watermilfoil, a notoriously invasive, non-native plant was found throughout much of Arlington Reservoir, its presence was not as dominating as it often becomes elsewhere, averaging an areal density of less than 5% across the 26 locations where it was found. Milfoil was dense in a few small areas along the southwest shore (see picture above), adjacent the dirt parking lot off Lowe Street, but for the most part was tertiary in overall plant cover. The distribution and density of all encountered milfoil growth can be seen in Figure 9 (Appendix A) found at the end of this report.

Water chestnut (*Trapa natans*), another notoriously problematic and invasive, non-native species was also found in the Arlington Reservoir at the time of the survey. Although thorough hand-pulling of water chestnut was performed three weeks prior (Aug. 9 & 10) to the Data Point Survey, small patches of immature water chestnut re-growth were observed along the Southern shoreline, extending into the northern third of the Reservoir. The observed chestnut growth was too immature to produce seeds in 2007, therefore no additional hand-pulling was necessary. Though growth of water chestnut still persists in Arlington Reservoir, low density coverage of this plant has been maintained following the mechanical harvesting effort (2000-2002). Prior to the

start of harvesting in 2000, it was estimated that dense water chestnut covered over 14 acres of the pond.

The one recognizable difference observed at Arlington Reservoir between the two survey dates was the emergence of spiny naiad in the Late Season Survey. Although, spiny naiad was identified on 7/31, it was generally low growing and scattered. By the time of the Data Point Survey, spiny naiad growth had expanded exponentially, coming to dominate many areas that had formerly been dominated by thinleaf pondweed. While this shift in vegetative cover was dramatic it is not unexpected as many naiad species tend to grow later in the season, only reaching full maturity by late summer.

Detailed data point location maps have been created for each of the identified species and can be found in at the end of this report (Appendix A - Figures 1-17). Below is a list of all of the aquatic plant species found in Arlington Reservoir at the time of the 2007 Vegetation Survey. The plants have been listed in order of abundance based on their frequency of occurrence at the 34 survey points sampled. Species encountered during the qualitative Mid Season Survey have also been included in the following list. These species along with other plant species identified during the Late Season Data Point Intercept Survey, but not found at specific sites, have been listed as "observed"

Plants of Arlington Reservoir – Listed by Order of Abundance

COMMON NAME	SCIENTIFIC NAME	FREQUENCY
Coontail (Cd)	<i>Ceratophyllum demersum</i>	79.4%
Eurasian Watermilfoil (Ms)	<i>Myriophyllum spicatum</i>	76.5%
Spiny Naiad (Nm)	<i>Najas minor</i>	61.8%
Thinleaf Pondweed (Pp)	<i>Potamogeton pusillus</i>	38.2%
Filamentous algae (Fa)		35.3%
Water Chestnut (Tn)	<i>Trapa natans</i>	32.4%
Veriegated water clover (Mm)	<i>Marsilea mutica</i>	8.8%
Waterweed (Ec)	<i>Elodea canadensis</i>	8.8%
Cattail (T)	<i>Typha latifolia</i>	2.9%
Pickerelweed (Pcord)	<i>Pontederia cordata</i>	2.9%
Water Willow (Dv)	<i>Decodon verticillatus</i>	2.9%
Bushy pondweed (Nf)	<i>Najas flexilis</i>	Observed
Watershield (B)	<i>Brasenia schreberi</i>	Observed
Cattail (T)	<i>Typha latifolia</i>	Observed
White waterlily (Ny)	<i>Nymphaea odorata</i>	Observed

Summary of Water Quality in Arlington Reservoir

Water quality samples were collected at each of the Arlington Ponds on 7/31 and 9/4/07. Samples were brought to MicoBac Laboratory in Marlborough, MA and analyzed for a suite of basic water quality parameters. Below you will find a summary of each of the water sample collection results with a brief discussion of the specific parameters and how it relates the waterbody. Similar discussions have been included for Menotomy Rocks Pond and Spy Pond.

Table 2 - Arlington Reservoir Water Quality 2007

Parameter	Unit	Dates		Average
		7/30	9/4	
pH	S.U.	8.88	8.53	8.71
Alkalinity	CaCO ₃ /L	48	44	46
Turbidity	NTU	0.75	4.2	2.48
Total Kjeldal Nitrogen	mg/L	0.62	0.53	0.58
Ammonia Nitrogen	mg/L	<0.05	<0.05	<0.05
Nitrate	mg/L	0.29	0.63	0.46
Total Phosphorus	mg/L	0.028	0.041	0.035
Dissolved Phosphorus	mg/L	<0.010	0.014	0.012*
True Color	Pt-Co	30	30	30
Apparent Color	Pt-Co	33	50	41.5
E.coli	CFU/100ml	<10	<10	<10
*one or more results below laboratory limits				

pH - is a measurement scale used to designate the degree of acid or alkaline condition of a solution. The scale ranges from 0, being the most acidic, to 14, being the most basic or alkaline. The pH value of 7 is considered to be neutral. A pH range of 5.5-8.5 is necessary to maintain a healthy fishery. The pH value obtained at Arlington Reservoir of 8.71 is slightly above the acceptable range but is not elevated enough to detrimentally affect fish populations or other aquatic inhabitants.

Total Alkalinity – Alkalinity is the measure of the buffering capacity of a waterbody against acid additions, such as acid rain and pollutants. Generally a value greater than 20mg/L is a sign that the waterbody is sufficiently protected against pH fluctuations. The result of 46 mg CaCO₃/L shows that the pond is well buffered and protected from adverse pH fluctuations that could otherwise be harmful to fish and other wildlife populations.

Turbidity – is a gauge of the amount of suspended solids and light refractory materials that are present in the water column. The measurement scale ranges from less than 10 to into the hundreds of units. Typically in non-polluted lakes the turbidity value rarely rises above five. The turbidity value obtained in this sampling round was 2.48 NTU, indicating low to moderate levels of suspended material, which can be comprised of suspended algae and/or non-living particulates such as suspended silt/clay, indicating that the reservoir has low levels of suspended materials.

Total Kjeldal Nitrogen (TKN) - is a measure of the nitrogen contained in organic compounds, such as proteins and amino acids, and as ammonia. It is created from biological growth and decomposition. A concentration of 1.0 mg/L or below is considered desirable. TKN values recorded at Arlington Reservoir were all desirably low, averaging 0.58 mg/L.

Ammonia Nitrogen – is an inorganic, dissolved form of nitrogen that can be found in water and is the preferred form for algae and plant growth. Ammonia is the most reduced form of nitrogen and is found in water where dissolved oxygen is lacking. Depending on temperature and pH (a measurement of “acidity”), high levels of ammonia can be toxic to aquatic life. High ammonia concentrations can stimulate excessive aquatic production and indicate pollution. Important sources of ammonia to waterbodies include: fertilizers, human and animal wastes, and by-products from industrial manufacturing processes. In general, acceptable ammonia concentrations should range between 0 and 0.05 mg/L depending upon temperature and pH. Generally values above 0.05 are considered problematic and potentially toxic to fish. The average Ammonia nitrogen levels in the pond were below laboratory detection limits (0.05 mg/L), indicating that Arlington Reservoir has little to no influence from any of the problematic sources listed above.

Nitrate - is usually the most prevalent form of nitrogen in water because it is the end product of the aerobic decomposition of organic nitrogen. Nitrate from natural sources is attributed to the oxidation of atmospheric nitrogen by bacteria and the decomposition of organic material in the soil. Nitrate concentrations may range from a few tenths to several hundred parts per million (mg/L). Generally, values greater than 0.3 mg/L are considered capable of supporting excessive vegetation and algae growth. The values obtained throughout the sampling regiment were generally close to, or above this threshold for most of the season. However, the values obtained for nitrate are well below drinking water standards (<10.0 mg/L) and are not cause for alarm.

Total and Dissolved Phosphorus – Phosphorus is considered the limiting nutrient essential to plant and algae growth. Typically a value of 0.03mg/L is sufficient to stimulate excessive plant and algae growth. Total phosphorous is a measure of all the various forms of phosphorus (dissolved and particulate) found in water. Dissolved phosphorus is readily available for plants, and consists of inorganic orthophosphate and organic phosphorus-containing compounds. The total phosphorus level obtained from Arlington Reservoir 0.035 is slightly above the aforementioned threshold and could result in problematic algae blooms; however it is important to recognize that this is merely a snap shot of the ever-fluctuating phosphorus levels in the reservoir. In order to establish a more meaningful baseline value, monthly or more frequent testing would be necessary. All reported dissolved phosphorus levels were also desirably low.

True and Apparent Color - Apparent color is the color of the whole water sample, and consists of color due to both dissolved and suspended components. True color is measured by filtering the water sample to remove all suspended material, and measuring the color of the filtered water, which represents color due to dissolved components.

To measure true color, the color of the filtered water sample is matched to one from a spectrum of standard colors. Each of the standard colors has been assigned a number on a scale of platinum-cobalt units (abbreviated as Pt-Co units). On the PCU scale, a higher value of true color represents water that is darker in color. (Lake water generally ranges between 0-500 Pt.-Co.)

Dissolved organic materials such as humic acids from decaying leaves, and dissolved minerals can give water a reddish brown "tea" color. The presence of color can reduce both the quantity and quality of light penetrating into the water column. Changing the quantity and quality of light reaching the bottom of a waterbody can influence the depth of colonization and the types of aquatic plants and algae that can grow there. In some waterbodies, color is the limiting environmental factor. For example, high color concentrations (greater than 50 PCU) may limit both the quantity and types of algae growing in a waterbody. Waterbodies that adjoin poorly drained areas (such as swamps) often have darker water, especially after a rainfall. Consequently, the location of a waterbody has a strong influence on its color. Color indexes in excess of 30 Pt-Co can cause significant reductions in water clarity. The 30 Pt-Co. index recorded here indicates that the water in the reservoir is generally darker in nature, which as mentioned above, is likely the result of water contact with decaying debris. The Apparent Color index of 50 recorded in September indicates an increased amount of suspended material, likely the result of increased runoff.

E. coli Bacteria – *E. coli* is one of many naturally occurring bacteria found within the intestine of healthy humans and animals. The presence of *E. coli* in pond and/or lake water is indicative of recent sewage or animal waste contamination. The Massachusetts Department of Public Health has standards for the presence of *E. coli* in "swimable waters". The current standard for freshwater is no single sample shall exceed 235 colonies per 100 ml. All values from the sampling effort were below detectable limits (10 per 100 ml), indicating little or no fecal contamination.

Menotomy Rocks Pond

Menotomy Rocks Pond is a roughly 2.3 acre waterbody located in Menotomy Rocks Park in Arlington. The pond was dredged in 1996 and is deep for a waterbody of its size with an average depth of about 6 feet and a maximum recorded depth of over 13 feet. 13 data points were established at the time of the survey yielding a data point frequency of approximately 5.6 points/acre.

The bottom substrate of Menotomy Rocks Pond is primarily composed of sand and gravel with and thin overlying layer of muck and leaf litter. Water clarity was good averaging over 11.5 feet between the two surveys. Dissolved oxygen levels were lower than what was recorded in Arlington Reservoir averaging approximately 90 % oxygen saturation through the first 8 feet of water (7.11 mg/L at 27.1°C on 7/31 & 7.27 mg/L at 24.4°C on 9/4/07). Algae counts were low in Menotomy Rocks Pond but were primarily dominated by *Microcystis* a common blue-green algae which accounted for nearly 1/2 (1,480 of 3,219) of the cells counted.

At the time of the Data Point Survey on 9/4/07 Menotomy Rocks Pond was generally devoid of vascular aquatic plant growth with only scattered growth of thin-leaf and curlyleaf pondweed. Although there was little vegetation to speak of, the Pond did support significant cover of stonewort (*Nitella* sp. – a plantlike macro algae) and filamentous algae. In general, nitella formed a desirably thick, low growing layer along the pond's bottom, most notably in the Southern half of the pond. Areas supporting stonewort also harbored moderate to thick cover of filamentous algae which formed a billowy blanket over the underlying stonewort. Some floating mats of filamentous algae were also found along the shore of the pond, but overall cover of floating mats was minimal.

Although devoid of most vascular plant growth during both vegetation surveys in 2007, Menotomy Rocks Pond does have a long-history of vegetation management. Following the dredging effort in 1996, the pond became inundated with growth of Eurasian watermilfoil. A Sonar herbicide treatment for the control of milfoil was conducted successfully in 2001, since which time little if any milfoil has been found in the pond an obvious result and benefit of the on-going management program. Subsequent Reward herbicide treatments have been performed annually to control curlyleaf pondweed, another invasive plant that has come to inhabit the pond. Prior to the most recent application of Reward (diquat) herbicide (6/11/07), it was estimated that curlyleaf pondweed covered approximately 20% of the pond, down from pre-treatment coverage in excess of 75% in 2002. Although consecutive treatments with Reward would undoubtedly affect the vegetative assemblage of the pond, very little native vegetation has been documented in the pond following the dredging project in 1996.

Detailed data point location maps have been created for each of the identified species and can be found in at the end of this report (Appendix B - Figures 18-27). Below is a list of all of the aquatic plant species found in Menotomy Rocks Pond in 2007.

Table 3

Menotomy Rocks Pond – Summary of Survey Results

Surface Area	2.3 –acres
Average Depth	5.9 –feet
Maximum Recorded Depth	13.1 –feet
# of Survey Points	13
# of Survey Points/acre	5.6
Overall Plant Cover	67%
Overall Plant Biomass	0.69
Dominant Species	Nitella Filamentous algae

Plants of Menotomy Rocks Pond – Listed by order of abundance

COMMON NAME	SCIENTIFIC NAME	FREQUENCY
Filamentous algae (Fa)		69%
Stonewort (Ni)	<i>Nitella sp.</i>	54%
Bushy Pondweed (Nf)	<i>Najas flexilis</i>	7.7%
Thinleaf Pondweed (Pp)	<i>Potamogeton pusillus</i>	7.7%
Curlyleaf pondweed (Pc)	<i>Potamogeton crispus</i>	7.7%
Yellow waterlily (Nu)	<i>Nuphar variegatum</i>	Observed
Cattail (T)	<i>Typha sp.</i>	Observed
Duckweed (Lm)	<i>Lemna sp.</i>	Observed

Summary of Water Quality in Menotomy Rocks Pond

Table 4 - Menotomy Rocks Pond Water Quality 2007				
		Dates		
Parameter	Unit	7/30	9/4	Average
pH	S.U.	7.64	7.60	7.62
Alkalinity	CaCO ₃ /L	56	53	54.5
Turbidity	NTU	0.7	0.62	0.66
Total Kjeldal Nitrogen	mg/L	0.53	0.65	0.59
Ammonia Nitrogen	mg/L	<0.05	<0.05	<0.05
Nitrate	mg/L	0.25	0.59	0.42
Total Phosphorus	mg/L	0.021	0.023	0.022
Dissolved Phosphorus	mg/L	<0.010	0.01	0.010*
True Color	Pt-Co	13	10	11.5
Apparent Color	Pt-Co	20	15	17.5
E.coli	CFU/100ml	<10	<10	<10
*one or more results below laboratory limits				

pH - The pH value obtained at Menotomy rocks Pond of 7.62 is well within the acceptable range and should be quite favorable to fish populations.

Total Alkalinity – The result of 54.5 mg CaCO₃/l shows that the pond is well protected from adverse pH fluctuations that can be harmful to fish and other wildlife populations.

Turbidity – The average turbidity value obtained from Menotomy Rocks pond was 0.66 NTU, indicating low levels of suspended material.

Total Kjeldal Nitrogen (TKN) - TKN values recorded at Menotomy Rocks Pond were all desirably low, averaging 0.59 mg/L.

Ammonia Nitrogen – The average Ammonia Nitrogen levels in the pond were below laboratory detection limits (0.05 mg/L), indicating that Menotomy Rocks Pond has little to no influence from any of the problematic sources listed above.

Nitrate - The values obtained throughout the sampling regiment were generally close to, or above the 0.3mg/L threshold for most of the season. However, the values obtained for nitrate are well below drinking water standards (<10.0 mg/L) and are not cause for alarm.

Total and Dissolved Phosphorus – The average phosphorus level recorded in Menotomy Rocks Pond was 0.022 mg/L which is below the 0.03 mg/L threshold needed to stimulate excessive algae growth. The dissolved phosphorus levels were also desirably low in all samples analyzed.

True and Apparent Color – average values of 11.75 and 17.5 indicate that the “color” of the water is not significantly impacted by either dissolved nutrients or suspended materials.

E. coli Bacteria – All values from the sampling regiment were below detectable limits (10 per 100 ml), indicating little or no fecal contamination.

Spy Pond

Spy Pond is the largest of the waterbodies surveyed in 2007 with a surface area of approximately 103 acres. The pond is comprised of two distinct basins that are separated by a large island directly south of the intersection of Chapman Street and Devereaux Street.

The substrate composition throughout the majority of Spy Pond is mixture of muck sand and gravel and varies greatly depending on location.

Although water clarity has slowly declined following the pond-wide Alum treatment in 2004, Secchi disk readings were good at the time of our inspections, averaging 8.75 feet between the two surveys (6.5 ft. – 7/31 & 11.0 ft. – 9/4/07). Dissolved oxygen levels were high throughout season averaging nearly 120% oxygen saturation through the first six meters of water (9.54 mg/L at 24.7°C on 7/31 & 9.70 mg/L at 23.8°C on 9/4/07). Algae counts were moderate in Spy Pond and were primarily dominated by the golden algae *Synura* which accounted for nearly 90% (11,248 of 12,654) of the cells counted. We expect that the Spy Pond Association monitored water clarity and water chemistry on a more frequent basis hence their data would more fairly represent summer-long conditions at Spy Pond.



Table 5

Spy Pond – Summary of Survey Results

Surface Area	103 –acres
Average Depth	14.4 –feet
Maximum Recorded Depth	38.9 –feet
# of Survey Points	51
# of Survey Points/acre	0.5
Overall Plant Cover	27.4%
Overall Plant Biomass	1.4
Dominant Species	Eurasian watermilfoil (exotic) Thinleaf pondweed

The South Basin of Spy Pond is approximately 47 acres in size and contained 25 data points (see Figure 30 – Appendix C). The South Basin was generally shallow with an average depth of only 9.3 feet, save for deeper hole in the southernmost cove where depth in excess of 20 feet were recorded. The South Basin of the Reservoir is moderately vegetated harboring growth of vascular plants at 17 of the 25

surveyed data points (68%), with an average areal coverage of 30% and an average overall biomass of 1.8. Excluding data points where no vegetation was found the average areal cover and biomass both increase to 45% and 2.6, respectively. Vegetation in the basin was primarily dominated by Eurasian watermilfoil which was encountered at 64% of the data collection sites. Lesser amounts of thinleaf pondweed and bushy pondweed (*Najas flexilis*) were also encountered during the survey. In general, Eurasian watermilfoil growth was widespread and could be found at water depths to about 10 -12 feet. Thinleaf pondweed was generally scarce throughout the basin but was observed in large patches mixed with Eurasian watermilfoil and claspingleaf pondweed (*Potamogeton perfoliatus*) to the southeast of the island, extending into the small cove near the access point off Spy Pond Parkway. Data points where no vegetation were found averaged over 17 feet in water depth.

The North Basin of Spy Pond is approximately 56 acres in size, containing 26 data collection points. By comparison to the South Basin the North Basin is sparsely vegetated, supporting vegetation at only 42% (11 of 26) of the surveyed locations. The lower overall vegetation cover is in large part due to the increased depth of the basin, averaging just over 19 feet. The overall biomass of the North Basin was also lower averaging 1.0 across the 26 points surveyed. Although considerably less prevalent, the vegetation composition in the North Basin was similar to that of the South Basin, consisting largely of Eurasian watermilfoil which was encountered at 38% of the data point locations. Thinleaf pondweed, the only other vascular plant identified in the North Basin was only found at 4 of the 26 points. In general, Eurasian watermilfoil cover was low averaging ~25% cover, save for the shallow cove north of Princeton Road (see picture right) where milfoil cover was between 75%-100% cover to depths of approximately 8 feet (see Figure 29). Most of the milfoil observed during the survey was at or within 1 foot of the Pond's surface. One notable difference at Spy Pond is the absence of coontail which was a prevalent plant in the vegetative community prior to the 2005 Sonar Treatment.



Detailed data point location maps have been created for each of the identified species and can be found in at the end of this report (Appendix C - Figures 28-38). Below is a list of all of the aquatic plant species identified at Spy Pond in 2007 Vegetation Survey. The plants have been listed in order of abundance based on their frequency of occurrence at the 51 survey points sampled. Species encountered during the qualitative Mid Season Survey have also been included in the following list. These species along with other plant species identified during the Late Season Data Point Intercept Survey, but not found at specific sites, have been listed as "observed".

Plants of Spy Pond – Listed by order of abundance

COMMON NAME	SCIENTIFIC NAME	FREQUENCY
Eurasian Watermilfoil (Ms)	<i>Myriophyllum spicatum</i>	51%
Thinleaf Pondweed (Pp)	<i>Potamogeton pusillus</i>	20%
Filamentous algae (Fa)		16%
Bushy Pondweed (Nf)	<i>Najas flexilis</i>	6%
Stonewort (Ni)	<i>Nitella sp.</i>	2%
Common Reed (Phrag)	<i>Phragmites australis</i>	2%
Sago Pondweed (Sp)	<i>Stuckenia pectinatus</i>	Observed
Clasping-leaf Pondweed (Pper)	<i>Potamogeton perfoliatus</i>	Observed
Snailseed Pondweed (Pb)	<i>Potamogeton bicupulatus</i>	Observed

Summary of Water Quality in Spy Pond

Four water quality samples were collected during each survey conducted at Spy Pond. Samples were collected at two different sites located in the South (Station 1) and North (Station 2) Basins. Two samples were collected at both locations, a surface sample and an “off-bottom” sample collected at 5 meters and 8 meters respectively. These additional samples were collected at Spy Pond because the pond thermally stratifies during the summer months which can cause differences in water quality between the epilimnion (water above the thermocline) and hypolimnion (water below the thermocline).

Table 6 – Summary of Water Quality Results at Spy Pond

Parameter	Unit	Station 1 - Surface		Station 1 - 5M		Station 2 - Surface		Station 2 - 8M		Average
		7/30	9/4	7/30	9/4	7/30	9/4	7/30	9/4	
pH	S.U.	8.76	8.56	6.71	7.02	8.64	8.52	7.85	8.52	8.07
Alkalinity	CaCO ₃ /L	39.0	39.0	47.0	38.0	41.0	38.0	43.0	48.0	41.6
Turbidity	NTU	2.0	0.85	0.98	0.85	1.90	1.00	2.00	0.90	1.31
Total Kjeldal Nitrogen	mg/L	0.86	0.43	2.10	0.50	0.66	0.54	0.71	0.67	0.81
Ammonia Nitrogen	mg/L	<0.05	<0.05	1.05	0.11	<0.05	<0.05	0.89	0.05	0.28*
Nitrate	mg/L	1.10	0.25	1.00	0.22	1.10	0.25	1.00	0.11	0.63
Total Phosphorus	mg/L	0.014	0.018	0.038	0.042	0.020	0.021	0.029	0.055	0.03
Dissolved Phosphorus	mg/L	<0.01	<0.01	0.01	0.018	<0.010	<0.01	<0.01	0.011	0.011*
True Color	Pt-Co	5	5	5	5	5	5	5	10	5.63
Apparent Color	Pt-Co	10	15	10	17	8	15	15	15	13.13
E.coli	CFU/100ml	<10	<10	<10	<10	<10	<10	<10	<10	<10
*one or more results below laboratory limits										

pH - The pH value obtained at Spy Pond of 8.07 is well within the acceptable range and should be quite favorable to fish populations and other pond inhabitants. Further, it is typical to have higher pH values surface waters when compared to those taken at depth.

Total Alkalinity – The result of 41.6 mg CaCO₃/l shows that the pond is sufficiently protected from adverse pH fluctuations that can be harmful to fish and other wildlife populations.

Turbidity – The average turbidity value obtained from Spy Pond was 1.31 NTU, indicating low to moderate levels of suspended and light refractory material.

Total Kjeldal Nitrogen (TKN) - TKN values recorded at Spy Pond were all desirably low, averaging 0.81 mg/L. The average Ammonia nitrogen levels in the pond near or below laboratory detection limits for almost all of the collected samples. The exception to this is the elevated levels (1.05 & 0.89) collected at depth on 7/31/07. Although these readings are higher than desired, they are likely a result of chemical exchange at the sediment-water interface, and are not cause for concern. In deeper stratifying waterbodies such as Spy Pond it is typical to record higher levels of nutrients (both TKN & Nitrate (below)) in the lower reaches of the water column due to the release of nutrients from the substrate and the stagnant nature of a pond's hypolimnion during stratification.

Nitrate - The values obtained throughout the sampling regiment were a little high, averaging 0.63mg/L. However, none of the values obtained for nitrate were above drinking water standards (>10.0 mg/L). Again, higher concentrations were recorded at depth.

Total and Dissolved Phosphorus – The average phosphorus level recorded in Spy Pond was 0.03 mg/L which is equal to the standard 0.03 mg/L threshold needed to stimulate excessive algae growth. Although phosphorus levels were slightly higher from the samples taken at depth, the maximum concentration of 0.055 mg/L is still quite low and encouraging for hypolimnetic (bottom) waters. The dissolved phosphorus levels were also desirably low in all samples analyzed.

True and Apparent Color – average values of 5.63 and 13.13 indicate that the “color” of the water is not significantly impacted by either dissolved nutrients or suspended materials.

E. coli Bacteria – All values from the sampling regiment were below detectable limits (10 per 100 ml), indicating little or no fecal contamination.

SUMMARY & RECOMMENDATIONS

Arlington Reservoir

The most pressing issue at Arlington Reservoir is the overabundance of coontail and non-native spiny naiad; and to a lesser degree Eurasian watermilfoil, water chestnut and thinleaf pondweed. At the time of the Late Season Survey these plants were growing in high density, topped-out beds throughout a majority of the waterbody. Although some open-water habitat was maintained in the center of the Reservoir, a greater part of the waterbody supported vegetation in excess of 75% cover with a high biomass of 3.5-4.

Unfortunately there is no easy solution for the situation facing Arlington Reservoir. Because both spiny naiad and Eurasian watermilfoil have the ability to reproduce through fragmentation many physical or mechanical control measures such as harvesting or hydro-raking are discouraged, because disturbance and “cutting” of these species often results in the further spread and dominance of the targeted plant. Hand-pulling/hand-harvesting would be nearly impossible due to the extent of growth and would cause the same concern for fragmentation.

The only reasonable approach to controlling the species found in Arlington Reservoir would be the use of USEPA/MA DAR registered herbicides. Reward (diquat) a broad-spectrum herbicide, used for control of curly-leaf pondweed in Menotomy Rocks Pond, could be used to gain temporary (seasonal) control of almost all of the problematic species in Arlington Reservoir, including spiny naiad, coontail, Eurasian watermilfoil, and thin-leaf pondweed. Likely one application of Reward would provide season-long control of the nuisance plants. As with all contact herbicides annual treatments would be necessary to maintain desired vegetation cover, though consecutive treatments do often reduce overall density and cover over time.

Reward can be used in a site specific manner (i.e. spot or partial pond treatment) and could be applied in areas of the reservoir to open recreational access, create more open-water habitat, or improve aesthetics, without removing all of the existing vegetation from the waterbody. Costs of a Reward based management program would vary depending on the size and scope of the project but would likely range between \$12,500 - \$15,000

It is also recommended that the hand-harvesting of water chestnut is also continued. Although it is estimated that greater than 90% of the seed-bearing water chestnut plants were removed by Aquatic Control hand-pullers in August 2007, some re-growth of water chestnut is expected in 2008, albeit at a reduced level. Because water chestnut is a true annual, reproducing solely from seed, it is possible to nearly eradicate this extremely invasive plant through careful monitoring and hand-pulling. The cost for hand-pulling water chestnut at Arlington Reservoir in 2008 would be similar to costs in 2007 ranging between \$2000 - \$3000.

Menotomy Rocks Pond

Although Menotomy Rocks Pond supported little vegetation at the time of our Data Point Survey, the pond does harbor a well-documented infestation of curly-leaf pondweed. This infestation has been actively managed for a number of years and has recently starting to show a decline in pre-treatment densities. In 2002 it was estimated that pre-treatment coverage of curly-leaf pondweed was upwards of 75%. Prior to treatment in 2007, densities of this noxious weed were estimated at only 20%. Although, curly-leaf is still easily found in the waterbody, consecutive years of treatment have started to deplete the pond's bank of reproductive wintering buds (turions), slowly reducing the cover of the plant in the waterbody. It is recommended that annual Reward treatments continue at Menotomy Rocks Pond to help continue the further depletion of the curlyleaf pondweed population in the pond.

Continued maintenance of algae is also recommended at Menotomy Rocks Pond. Use of both Alum and copper-based algaecide treatments have improved and maintained water clarity, reducing overall cover of filamentous algae and controlling nuisance algae blooms. The cost for the continued maintenance of Menotomy Rocks Pond, including herbicide/algaecide treatments and alum applications will cost approximately \$5,000 - \$7,000, depending on the level of vegetation control needed or the number of algaecide treatments required.

Spy Pond

The extent of the Eurasian milfoil infestation in Spy Pond precludes the use of physical removal techniques such as hand-harvesting or suction harvesting as the primary management strategies. Benthic weed barriers would also be impractical due to the cost and potential impacts of covering such a large areas. As mentioned above, mechanical methods are generally discouraged for plants like milfoil that spread by fragmentations.

Treatment with US EPA / MA DAR registered herbicides, has been in the past, and continues to be the most effective option for managing Eurasian watermilfoil at Spy Pond. Several aquatic herbicides will provide control of Eurasian milfoil. Treatment with Reward (diquat) would typically provide seasonal control of the milfoil, however systemic products like Sonar (fluridone), Renovate (triclopyr) and Navigate (2,4-D) would typically provide multiple years of control. Sonar has been applied at Spy Pond in the past, most recently in 2005, and has provided excellent control of Eurasian watermilfoil for 2-3 years. The cost for another whole-lake Sonar treatment program at Spy pond in 2008 would cost in the order of \$35,000.

Sonar (fluridone) works by inhibiting the synthesis of carotenoids, pigments within the plants that protect chlorophyll from degradation by sunlight. Sonar works slowly and required a 45-60 day contact time with targets plants for most effective control. Since Sonar is highly soluble and has a half-life of ~ 24-days, multiple applications are usually necessary to ensure this contact time, especially in high-flow systems. Additionally, because of its high solubility, conducting partial lake treatments are more difficult and require the use of the pellet formulations which release the active ingredient over a period of time. Although it may not be of interest to treat the Eurasian watermilfoil in 2008, it is likely that without treatment nuisance densities of this plant will return quickly requiring some form of management in the near future. If the Town's budget allows, we would suggest pursuing a whole-pond Sonar treatment in 2008. Although, nuisance densities of milfoil may not be wide-spread for a few years, successful, lasting control becomes increasingly more difficult the more established and mature individual plants and their "root crowns" become.

In our experience, longer-lasting control of milfoil is more easily achieved on newly established plants; while those that have survived for a number of years are more likely to rebound due to the stored energy in their root-crowns. Although Sonar is systemic in nature and does “kill” the root of the plant, the milfoil root-crowns grown larger and stronger with each growing season, making complete control more difficult to attain.

Plan for Future Vegetation Monitoring

The level of detail and methodology used in the 2007 surveys can be replicated to monitor future changes in the vegetation assemblage of these waterbodies. Costs could be somewhat reduced from this year, as some of the preparation and mapping tasks would not need to be repeated.

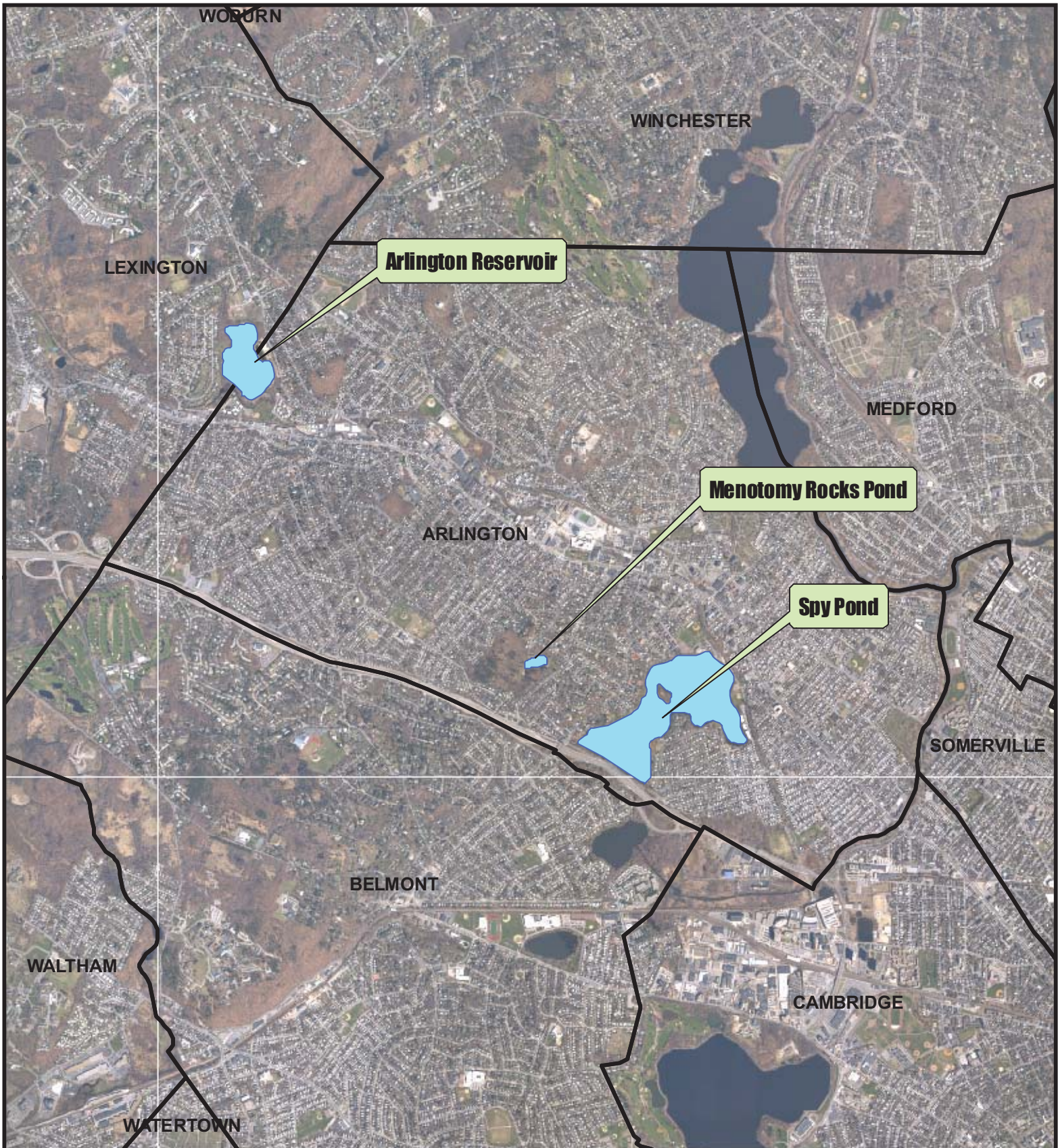
Based on what we now know about these waterbodies, it does not appear necessary to repeat the complete comprehensive surveys on each waterbody annually. We’d recommend repeating these Data Point Surveys every other year initially and then possibly even moving to every third year. It would not be recommended to go longer than three years, in the event a new invasive species become introduced that may require a rapid response. We’d therefore recommend that all of the surveys be completed on a two-year schedule beginning in 2009. Following that year, a decision can be made to move on whether to go to a three-year schedule. Of course, if the need arises, whether from the introduction of a new invasive species or because some management work is planned, individual waterbodies can be surveyed more frequently.

Although we do not see the need to replicate the plant surveys in 2008, we would recommend that the Town continue with a “scaled-back” monitoring plan that includes the collection of at least one round of water quality samples (preferably later in the summer) and at least one qualitative vegetation inspection at each of the waterbodies. A monitoring plan of this scope will cost approximately \$5,000 for all three waterbodies.

APPENDIX A

Arlington Reservoir Data Point Locations & Vegetation Coverage
(Figures 1 – 17)

Data Tables form Arlington Reservoir Data Point Vegetation
Survey – 9/4/07



Arlington Ponds

Site Locus Map
<Figure 1 click to edit>

FIGURE:	SURVEY DATE:	MAP DATE:
1	—	12/14/07

Legend:



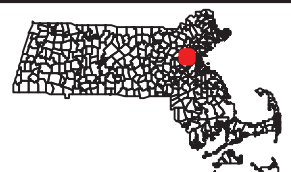
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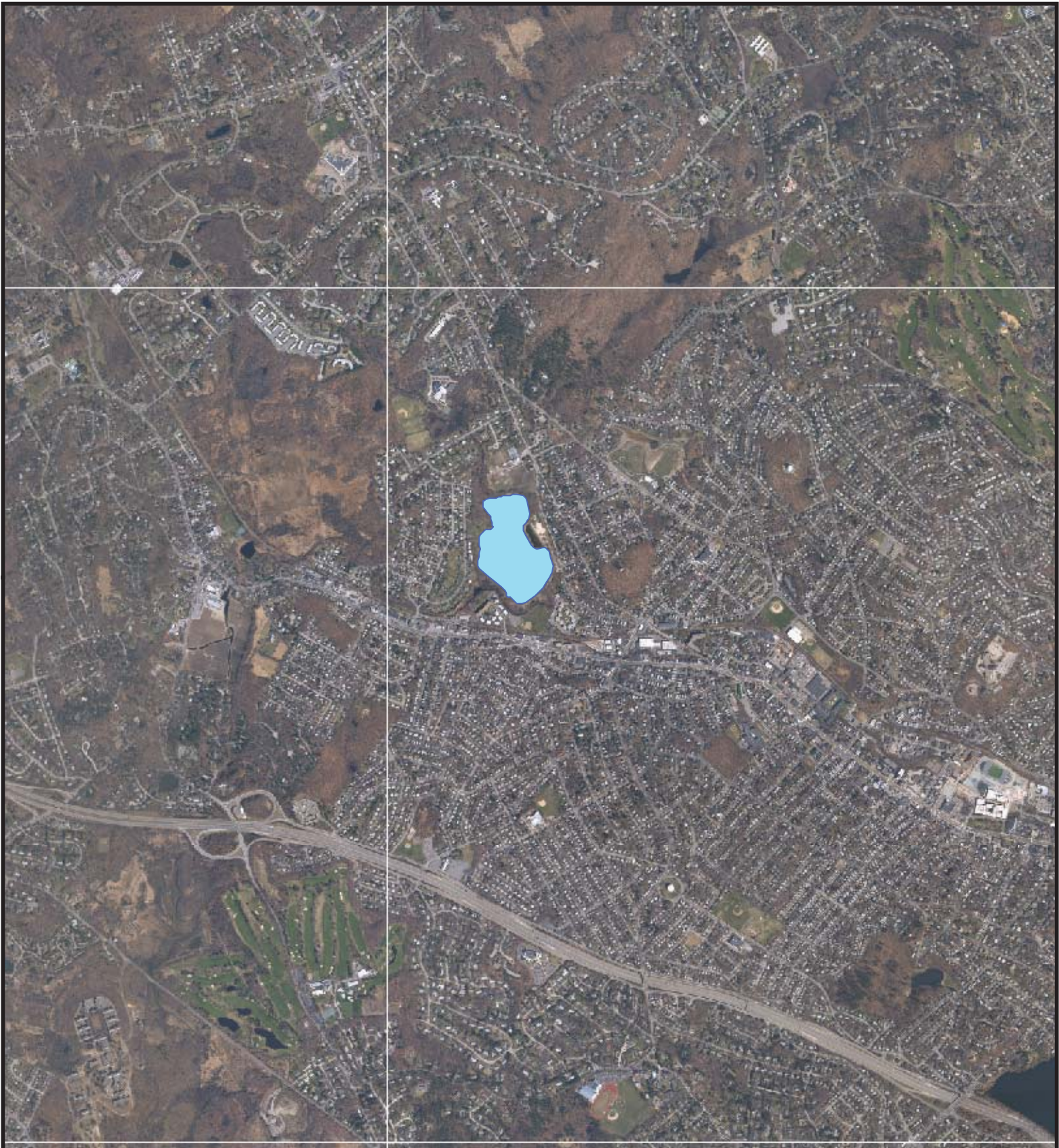
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Arlington Reservoir

Arlington & Lexington, MA

Site Locus

Legend:



Arlington Reservoir (~28 acres)



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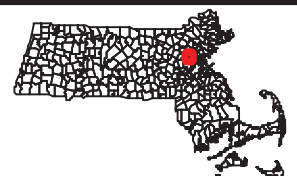


FIGURE:

2

SURVEY DATE:

9/4/07

MAP DATE:

12/12/07

0 0.125 0.25 0.5 0.75 1 Miles



Arlington Reservoir

Arlington & Lexington, MA

Data Point Map

Legend:

- Survey point locations (34 points) - Actual locations of survey points captured by GPS during the 2007 Vegetation Survey. Survey based on 60 meter Survey Grid.

Arlington Reservoir (~28 acres)



0 75 150 300 450 600 Feet



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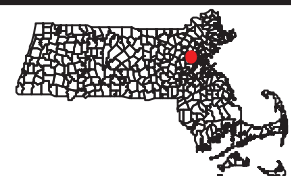


FIGURE:

4







SURVEY DATE:

9/4/07

MAP DATE:

12/12/07

Legend

-  Dominated by dense growth of (80%-100% cover) *Najas minor*, with lesser amounts of *Potamogeton pusillus*, *Ceratophyllum demersum*, *Myriophyllum spicatum*, scattered *Trapa natans*, and shoreline growth of *Marsilea mutica* (Biomass 4)
-  Dominated by dense growth (80%-100% cover) *Ceratophyllum demersum* with lesser amounts of *Myriophyllum spicatum*, *Potamogeton pusillus*, *Najas minor* and scattered *Trapa natans* (Biomass 3-4)
-  Scattered growth (5%-15% cover) of *Ceratophyllum demersum* and Eurasian watermilfoil (Biomass 2-3)
-  Dominated by dense growth (80%-100% cover) of *Potamogeton pusillus* and *Elodea canadensis* with lesser amounts of *Ceratophyllum demersum* (Biomass 3-4)
-  Moderate growth (25%-50% over) of *Myriophyllum spicatum* with low growing *Elodea c canadensis* (Biomass 3)
-  Dense growth (80%-100% over) of *Ceratophyllum demersum* (Biomass 3)



Arlington Reservoir

Arlington & Lexington, MA

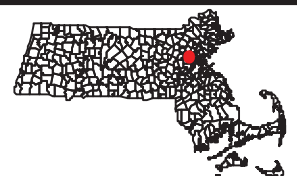
Vegetation Assembly Map

FIGURE:	SURVEY DATE:	MAP DATE:
3	9/4/07	12/12/07



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Arlington Reservoir

Arlington & Lexington, MA

Data Point Map

Legend:

- Survey point locations (34 points) - Actual locations of survey points captured by GPS during the 2007 Vegetation Survey. Survey based on 60 meter Survey Grid.

Arlington Reservoir (~28 acres)



0 75 150 300 450 600 Feet



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FIGURE:

4

SURVEY DATE:

9/4/07

MAP DATE:

12/12/07



Arlington Reservoir

Arlington & Lexington, MA

Vegetation Coverage Map

Legend:

- 1%-25% vegetation cover
- 26%-50% vegetation cover
- 51%-75% vegetation cover
- 76%-100% vegetation cover



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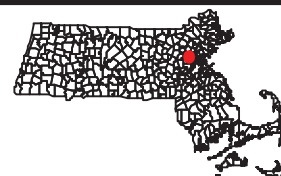


FIGURE:	SURVEY DATE:	MAP DATE:
5	9/4/07	12/12/07



Arlington Reservoir
Arlington & Lexington, MA
Vegetation Biomass Map

Legend:

- Biomass 1
- Biomass 2
- Biomass 3
- Biomass 4



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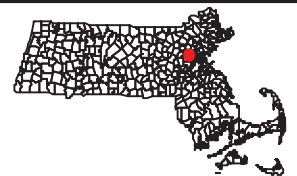


FIGURE:	SURVEY DATE:	MAP DATE:
6	9/4/07	12/12/07



Arlington Reservoir

Arlington & Lexington, MA

Ceratophyllum demersum Coverage Map

Legend:

- 1%-25% cover *Ceratophyllum demersum*
- 26%-50% cover *Ceratophyllum demersum*
- 51%-75% cover *Ceratophyllum demersum*
- 76%-100% cover *Ceratophyllum demersum*



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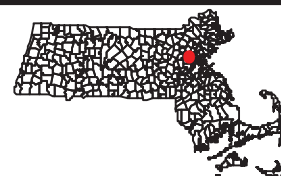


FIGURE:

7

SURVEY DATE:

9/4/07

MAP DATE:

12/12/07



Arlington Reservoir

Arlington & Lexington, MA

Najas minor Coverage Map

Legend:

- 1%-25% cover *Najas minor*
- 26%-50% cover *Najas minor*
- 51%-75% cover *Najas minor*
- 76%-100% cover *Najas minor*



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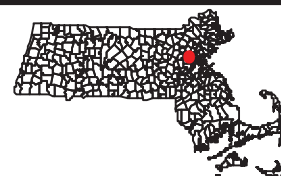


FIGURE:

8

SURVEY DATE:

9/4/07

MAP DATE:

12/12/07



Arlington Reservoir

Arlington & Lexington, MA

Myriophyllum spicatum Coverage Map

Legend:

- 1%-25% cover *Myriophyllum spicatum*
- 26%-50% cover *Myriophyllum spicatum*
- 51%-75% cover *Myriophyllum spicatum*
- 76%-100% cover *Myriophyllum spicatum*



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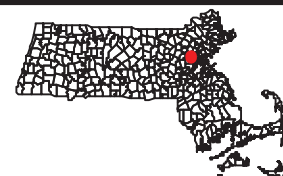


FIGURE:

9

SURVEY DATE:

9/4/07

MAP DATE:

12/12/07

Locations of *Potamogeton pusillus*



Figure 10

Locations of Filamentous algae



Figure 11

Locations of *Trapa natans*



Figure 12

Locations of *Marsilea mutica*



Figure 13

Locations of *Elodea canadensis*

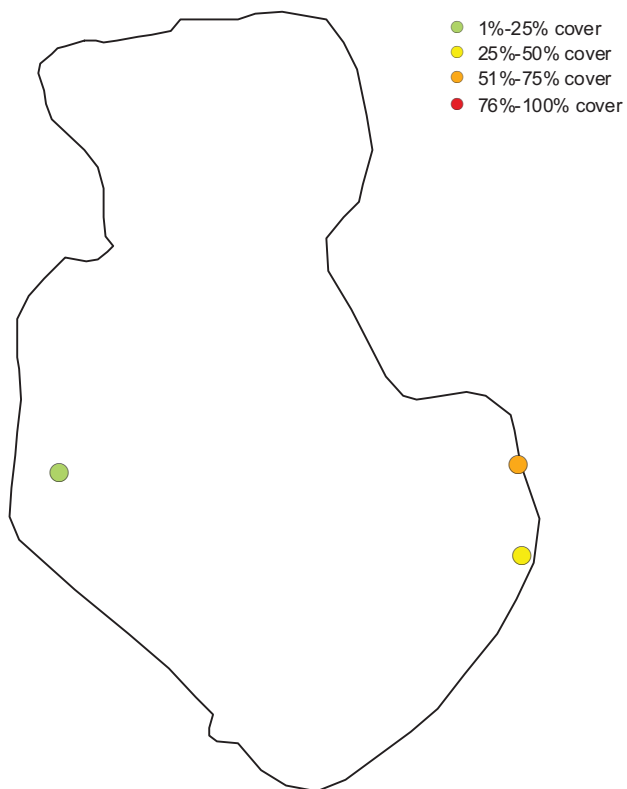


Figure 14

Locations of *Typha* sp.



Figure 15

Locations of *Decodon verticillatus*



Figure 16

Locations of *Polygonum* sp.



Figure 17

Arlington Reservoir

Data Point #	LAT	LONG	WaterDepth	Sediment Type	Biomass	Total Cover	Cd	Ms	Nm	Pp	Fa	Tn	Mm	Ec	T	D	Polg
1	42.43127751	-71.18910265	2.9	S/G	4	145	T	T	95		10	T	20		25		
2	42.43094635	-71.18841198	3.8	M/G	4	170	10		90		70						
3	42.43082757	-71.18907038	4.7	M	4	150	T	T	95		50	T					
4	42.4302078	-71.18981889	3.5	M/G	4	70		T	65	T							
5	42.43082045	-71.19049983	1.2	M	4	100	T	T	80	20		T	T				
6	42.43032868	-71.18983934	5.1	M	4	100	5	T	85	10	20	T					
7	42.43031393	-71.18908287	4.9	M	4	150	5	T	75	20	50	T					
8	42.43029482	-71.18841098	2.0	R/G	3	120	5	T	95	20	20						
9	42.42977715	-71.1884031	2.5	S/G	4	110	5	T	5				100			T	
10	42.42975955	-71.18909821	5.2	SM	4	100	5	T	15	80		T					
11	42.42980121	-71.18980799	5.4	M	3.5	100	10	5	50	30	5						
12	42.42972108	-71.19053453	4.0	R/S/M	4	160	50	5	25	20	60	T					
13	42.42926292	-71.1905342	5.1	M	4	170	10	T	70	20	70	T					
14	42.42922579	-71.18987362	5.8	M	2.5	100	85	5	10								
15	42.42923887	-71.18914272	6.6	M	2.5	30	20	10									
16	42.42921799	-71.18839463	7.6	M	1	5		5									
17	42.42869823	-71.18693065	3.3	R/S	2	100	20	5	10	5				60			T
18	42.42864249	-71.18764085	6.2	M	2.5	100	85			15							
19	42.42862757	-71.18842548	7.5	M	0	0											
20	42.428666328	-71.1890584	6.6	M	2	20	20										
21	42.42864509	-71.18987664	6.1	M	2	20											
22	42.42865582	-71.19061584	5.7	M	4	95	80	T	T		10	T		T			
23	42.42820135	-71.19056052	3.4	M	4	100	95	T	T	T							
24	42.4281809	-71.1898447	7.0	M	1	5		5									
25	42.42819096	-71.18912159	6.7	M	1	5		5									
26	42.42816565	-71.18839304	6.9	M	0	0											
27	42.42815726	-71.18766055	5.7	M	3.5	100	90	5	5								
28	42.42816213	-71.18690575	3.4	S	3.5	100	10	10	20	30				30			
29	42.42761395	-71.18760103	6.5	M	3.5	100	90	10									
30	42.42755092	-71.1883725	6.1	M	3	5	5										
31	42.42760431	-71.1891029	6.6	M	3	75	75										
32	42.42761923	-71.18981034	5.7	M	4	100	95	T	T			T					
33	42.42709897	-71.18912553	3.8	R	4	130	95	T	5	T	30						
34	42.42709822	-71.18834116	6.5	M	3.5	95	75	T			20						
Average			5.1		3.5	74*	Frequency Count	79.4%	76.5%	61.8%	38.2%	35.3%	32.4%	8.8%	8.8%	2.9%	2.9%

Temperature Dissolved Oxygen Profiles

7/30/2007		
Depth (ft)	Temp	DO
S	27.9	9.57
1	27.4	9.83
2	27.0	9.65
3	26.8	9.89
4	26.7	10.14
5	25.7	9.07
6	24.7	>1.25

9/4/2007

Depth (ft)	Temp	DO
S	23.5	8.78
1	23.4	8.54
2	23.2	8.52
3	23.3	8.51
4	23.2	8.49
5	23.2	8.25
6	23.1	5.04

Table 3 - Arlington Reservoir Water Quality 2007

Parameter	Unit	Dates		
		7/30	9/4	Average
pH	S.U.	8.88	8.53	8.71
Alkalinity	CaCO3/L	48	44	46
Turbidity	NTU	0.75	4.2	2.48
Total Kjeldal Nitrogen	mg/L	0.62	0.53	0.58
Ammonia Nitrogen	mg/L	<0.05	<0.05	<0.05
Nitrate	mg/L	0.29	0.63	0.46
Total Phosphorus	mg/L	0.028	0.041	0.035
Dissolved Phosphorus	mg/L	<0.010	0.014	0.012*
True Color	Pt-Co	30	30	30
Apparent Color	Pt-Co	33	50	41.5
E.coli	CFU/100ml	<10	<10	<10
Secchi Disk Clarity	Ft.	4.3	3.1	3.7

*one or more laboratory results below detection limit

APPENDIX B

Menotomy Rocks Pond Data Point Locations & Vegetation
Coverage (Figures 18 – 28)

Data Tables form Menotomy Rocks Pond Data Point Vegetation
Survey – 9/4/07



Menotomy Rocks Pond

Arlington, MA

Site Locus Map

Legend:



Menotomy Rocks Pond (2.3 acres)

N



0 150 300 600 900 1,200 Feet



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FIGURE:

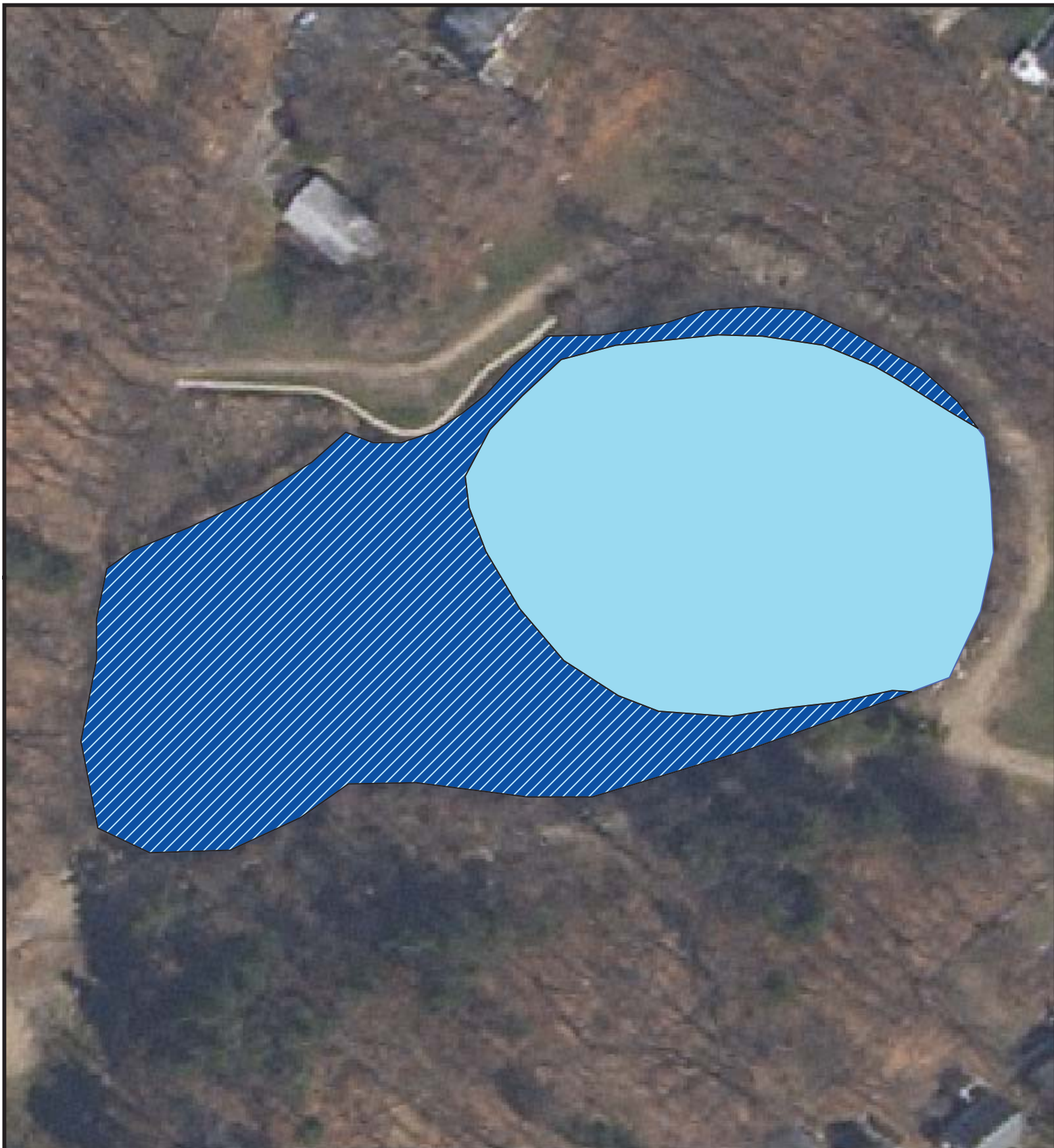
18

SURVEY DATE:

9/4/07

MAP DATE:

12/14/07



Menotomy Rocks Pond

Arlington, MA

Vegetation Assembly Map

FIGURE:

19

SURVEY DATE:

9/4/07

MAP DATE:

12/14/07

Legend:



Moderate to dense (50%-100% cover)
Nitella sp. and filamentous algae with
 very scattered growth of *Potamogeton*
pusillus, *Potamogeton crispus* and *Najas*
flexilis



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Menotomy Rocks Pond

Arlington, MA
Data Point Map

Legend:



Survey point locations (13 points) - Actual locations of survey points captured by GPS during the 2007 Vegetation Survey.



Menotomy Rocks Pond (2.3 acres)



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FIGURE:

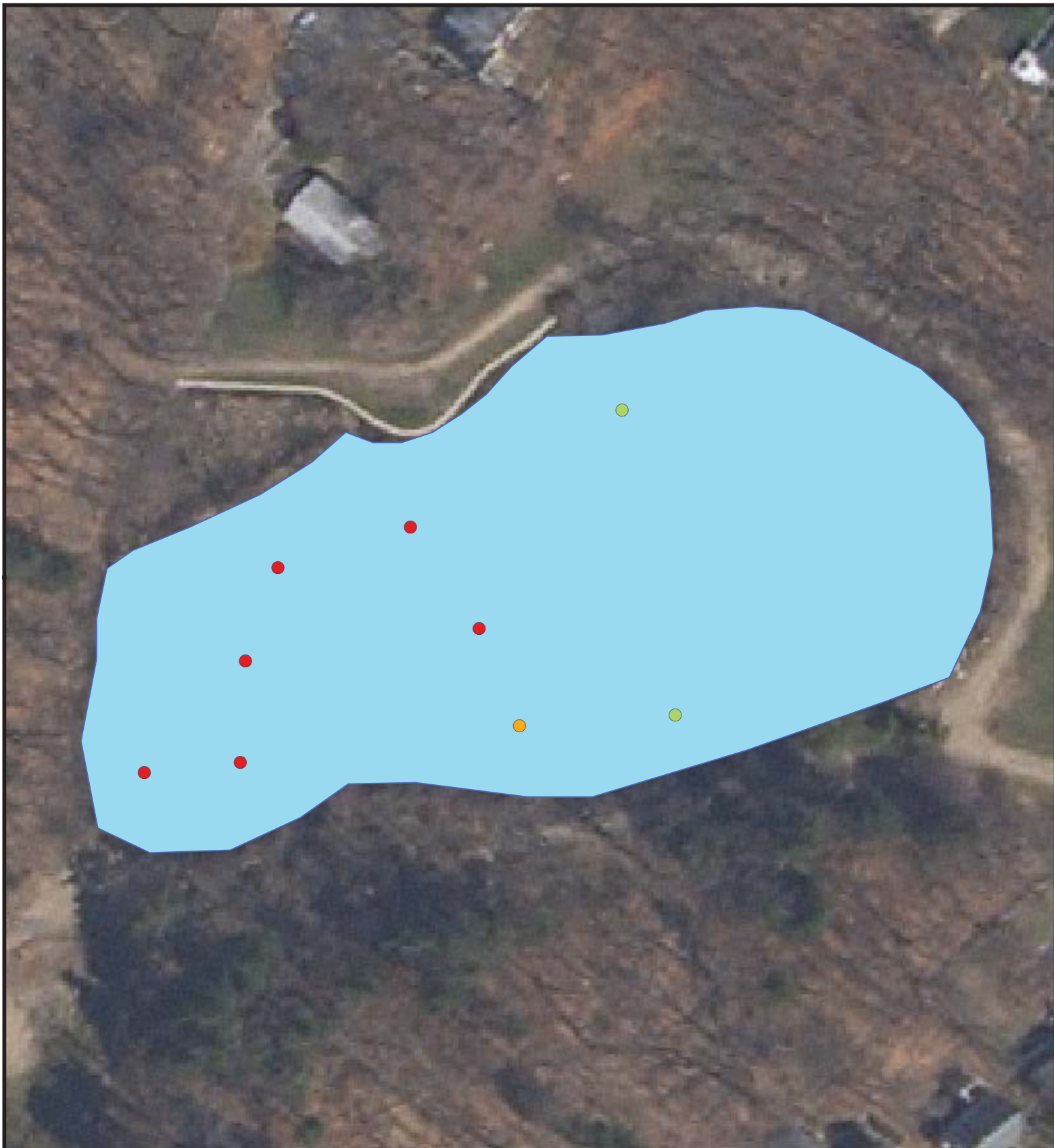
20

SURVEY DATE:

9/4/07

MAP DATE:

12/14/07



Menotomy Rocks Pond

Arlington, MA

Vegetation Coverage Map

Legend:

- 1%-25% vegetation cover
- 26%-50% vegetation cover
- 51%-75% vegetation cover
- 76%-100% vegetation cover



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FIGURE:

21

SURVEY DATE:

9/4/07

MAP DATE:

12/14/07



Menotomy Rocks Pond

Arlington, MA

Biomass Map

FIGURE:	SURVEY DATE:	MAP DATE:
22	9/4/07	12/14/07

Legend:

- Biomass 1
- Biomass 2
- Biomass 3
- Biomass 4



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Menotomy Rocks Pond

Arlington, MA

Nitella sp. Coverage Map

Legend:

- 1%-25% cover of *Nitella sp.*
- 26%-50% cover of *Nitella sp.*
- 51%-75% cover of *Nitella sp.*
- 76%-100% cover of *Nitella sp.*



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FIGURE:

23

SURVEY DATE:

9/4/07

MAP DATE:

12/14/07

Locations of Filamentous algae

- 1%-25% cover
- 25%-50% cover
- 51%-75% cover
- 76%-100% cover

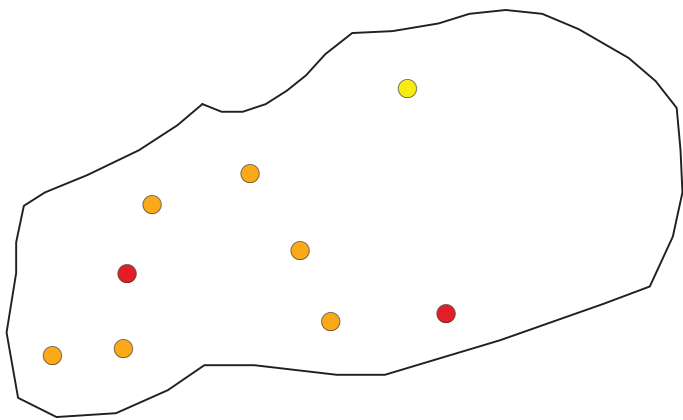


Figure 24

Locations of *Najas flexilis*

- 1%-25% cover
- 25%-50% cover
- 51%-75% cover
- 76%-100% cover

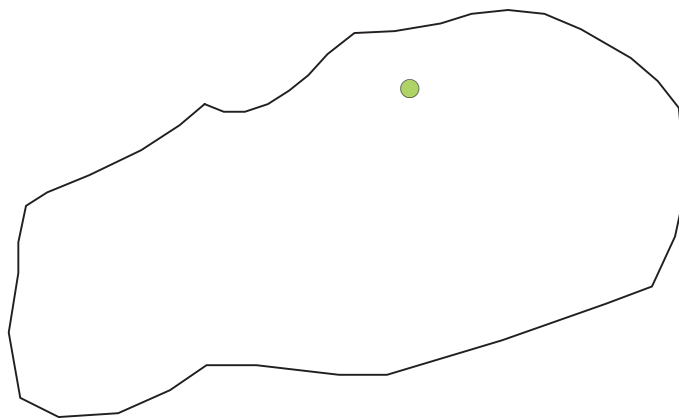


Figure 25

Locations of *Potamogeton crispus*

- 1%-25% cover
- 25%-50% cover
- 51%-75% cover
- 76%-100% cover

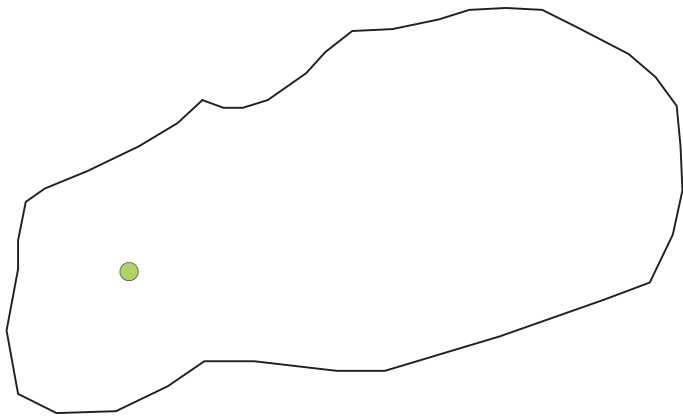


Figure 26

Locations of *Potamogeton pusillus*

- 1%-25% cover
- 25%-50% cover
- 51%-75% cover
- 76%-100% cover



Figure 27

Menotomy Rocks Pond

Data Pont #	LAT	LONG	Water Depth	Sediment Type	Biomass	Total Cover	Fa	Ni	Nf	Pc	Pp
1	42.41116832	-71.16507023	4.5	M	0	0					
2	42.410969	-71.16508171	10.5	S	0	0					
3	42.41079281	-71.16507316	6.6	R	0	0					
4	42.41073238	-71.16530165	3.5	M	1	100	100				
5	42.41095341	-71.16547373	13.1	M	0	0					
6	42.41119095	-71.1654071	6.5	M	1	75	50		25		
7	42.4110177	-71.16583575	3.5	R/S	1	175	75	100			
8	42.41086531	-71.16569887	7.6	M	1	175	75	100			
9	42.41071913	-71.16561689	4.2	M	1	150	75	75			
10	42.41066608	-71.16618334	4.5	R/S/M	1	175	75	100			
11	42.41081762	-71.16617102	4.6	M	1	175	100	75		T	
12	42.41095777	-71.16610598	4.6	R/S/M	1	180	75	85			20
13	42.4106504	-71.16637805	3.1	R/S/M	1	175	75	100			
			5.907692308		0.69	67.3*					
						Frequency	69.2%	53.8%	7.7%	7.7%	7.7%
						Count	9	7	1	1	1

Temperature Dissolved Oxygen Profiles		
7/31/2007		
Depth (ft.)	Temp (c)	DO
S	28.1	8.28
1	28.0	7.34
2	27.5	7.24
3	27.3	7.06
4	27.2	6.99
5	27.1	6.87
6	26.7	7.06
7	26.2	6.90
8	25.6	6.27
9	24.8	2.79

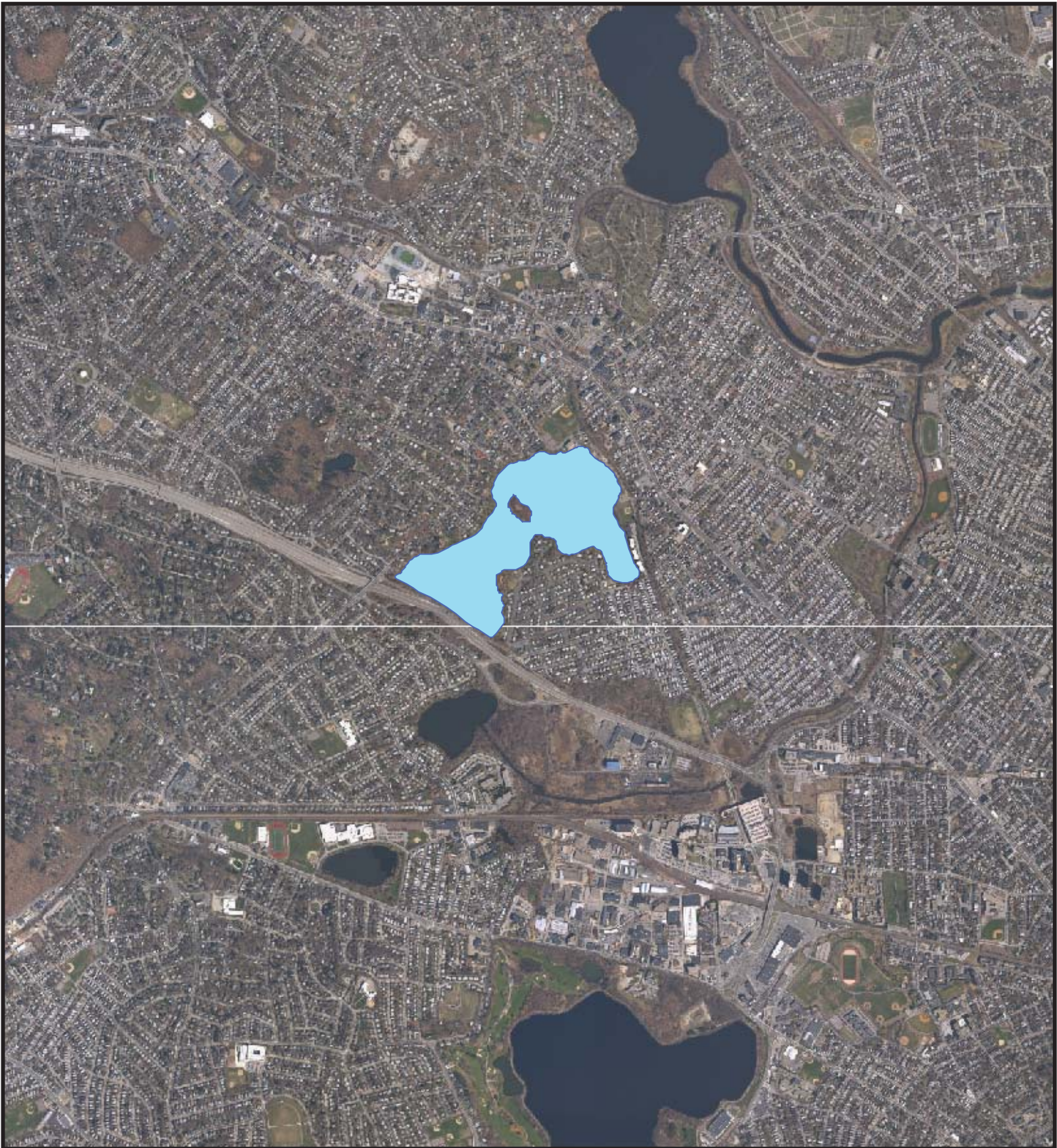
9/4/2007		
Depth (ft.)	Temp (c)	DO
S	24.6	7.59
1	24.6	7.62
2	24.5	7.46
3	24.4	7.33
4	24.4	7.29
5	24.4	7.26
6	24.3	7.15
7	24.3	6.99
8	24.3	6.74
9	24.1	6.64

Table 4 - Menotomy Rocks Pond Water Quality 2007				
Parameter	Unit	Dates		Average
		7/30	9/4	
pH	S.U.	7.64	7.60	7.62
Alkalinity	CaCO3/L	56	53	54.5
Turbidity	NTU	0.7	0.62	0.66
Total Kjeldal Nitrogen	mg/L	0.53	0.65	0.59
Ammonia Nitrogen	mg/L	<0.05	<0.05	<0.05
Nitrate	mg/L	0.25	0.59	0.42
Total Phosphorus	mg/L	0.021	0.023	0.022
Dissolved Phosphorus	mg/L	<0.010	0.01	0.010*
True Color	Pt-Co	13	10	11.5
Apparent Color	Pt-Co	20	15	17.5
E.coli	CFU/100ml	<10	<10	<10
Secchi disk	ft.	9.3	13.1	11.2
*one or more laboratory results below detection limit				

APPENDIX C

Spy Pond Data Point Locations & Vegetation Coverage
(Figures 29 – 38)

Data Tables form Spy Pond Data Point Vegetation Survey –
8/31/07



Spy Pond

Arlington, Ma

Site Locus Map

Legend:



Spy Pond (103 acres)



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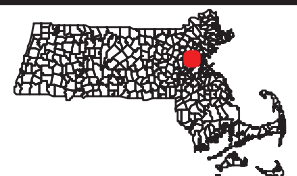


FIGURE:

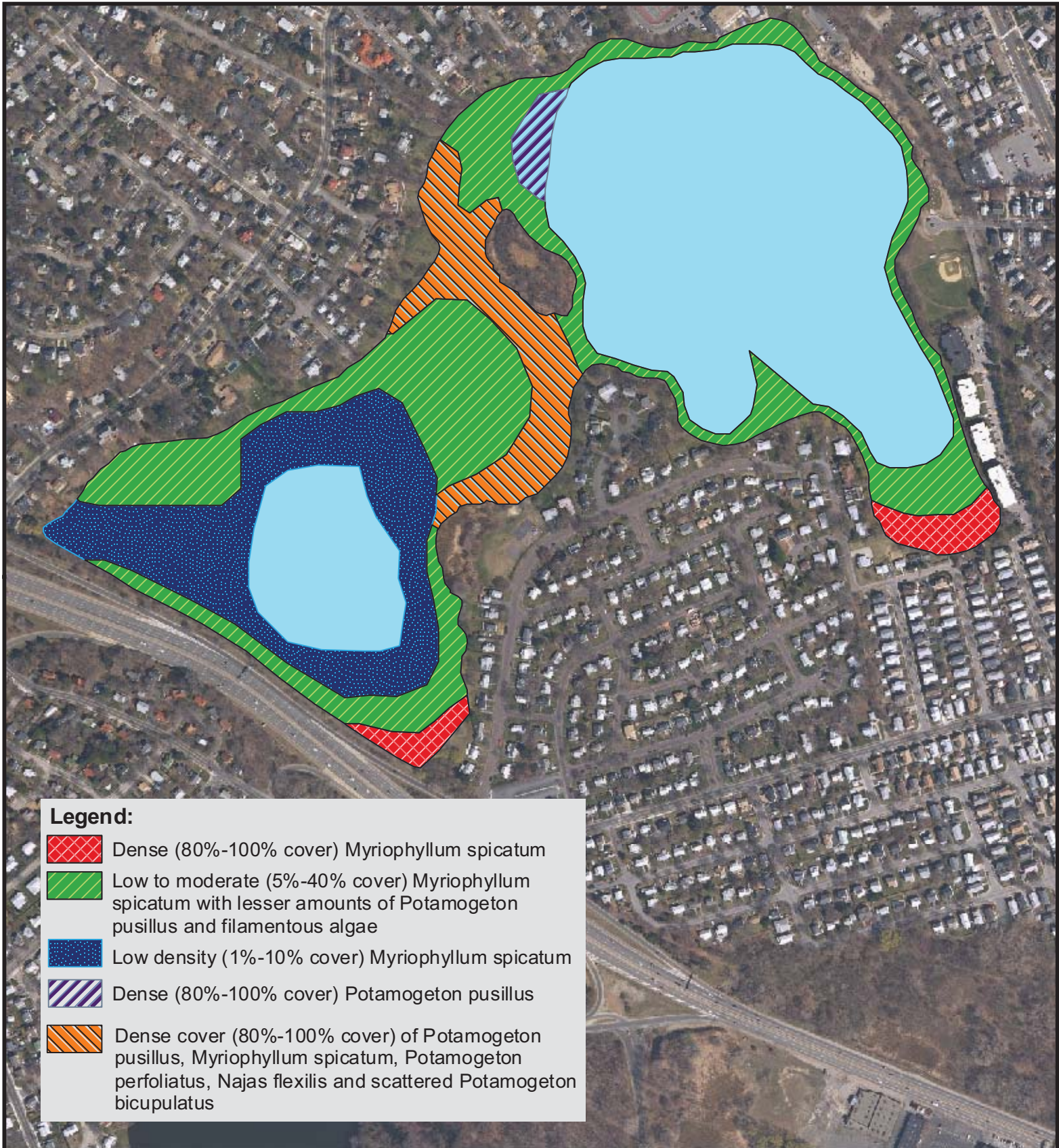
28

SURVEY DATE:

8/31/07

MAP DATE:

12/14/07



Spy Pond

Arlington, Ma

Vegetation Assemblage Map

FIGURE:

29

SURVEY DATE:

8/31/07

MAP DATE:

12/14/07

0 150 300 600 900 1,200 Feet



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Spy Pond

Arlington, Ma

Data Point Map

Legend:

- Survey point locations (51 points) - Actual locations of survey points captured by GPS during the 2007 Vegetation Survey. Survey based on 90 meter Survey Grid

Spy Pond (103 acres)

N



0 150 300 600 900 1,200 Feet



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FIGURE:

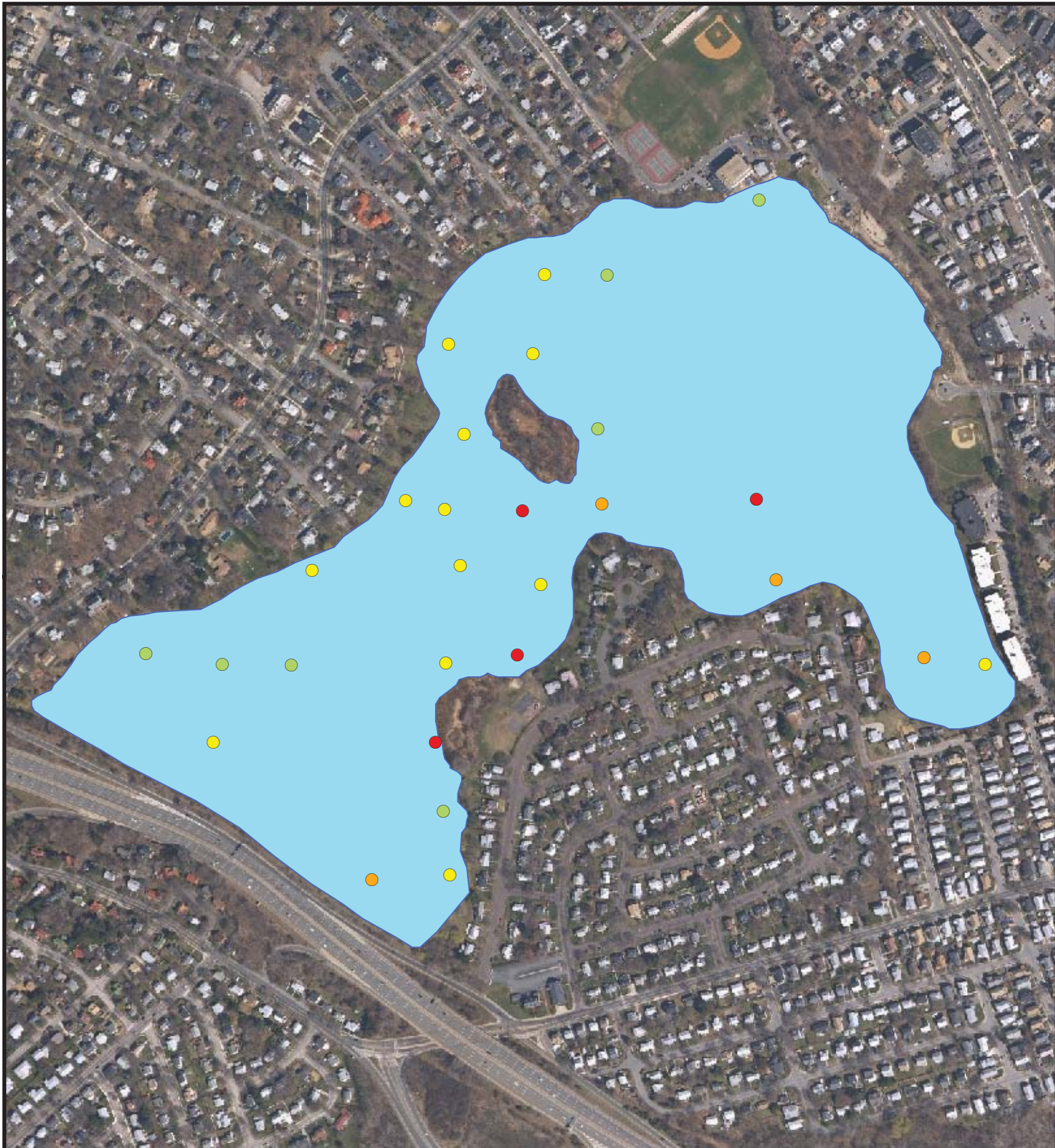
30

SURVEY DATE:

8/31/07

MAP DATE:

12/14/07



Spy Pond

Arlington, Ma

Vegetation Coverage Map

Legend:

- 1%-25% vegetation cover
- 26%-50% vegetation cover
- 51%-75% vegetation cover
- 76%-100% vegetation cover



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FIGURE:

31

SURVEY DATE:

8/31/07

MAP DATE:

12/14/07



Spy Pond Arlington, Ma Biomass Map

Legend:

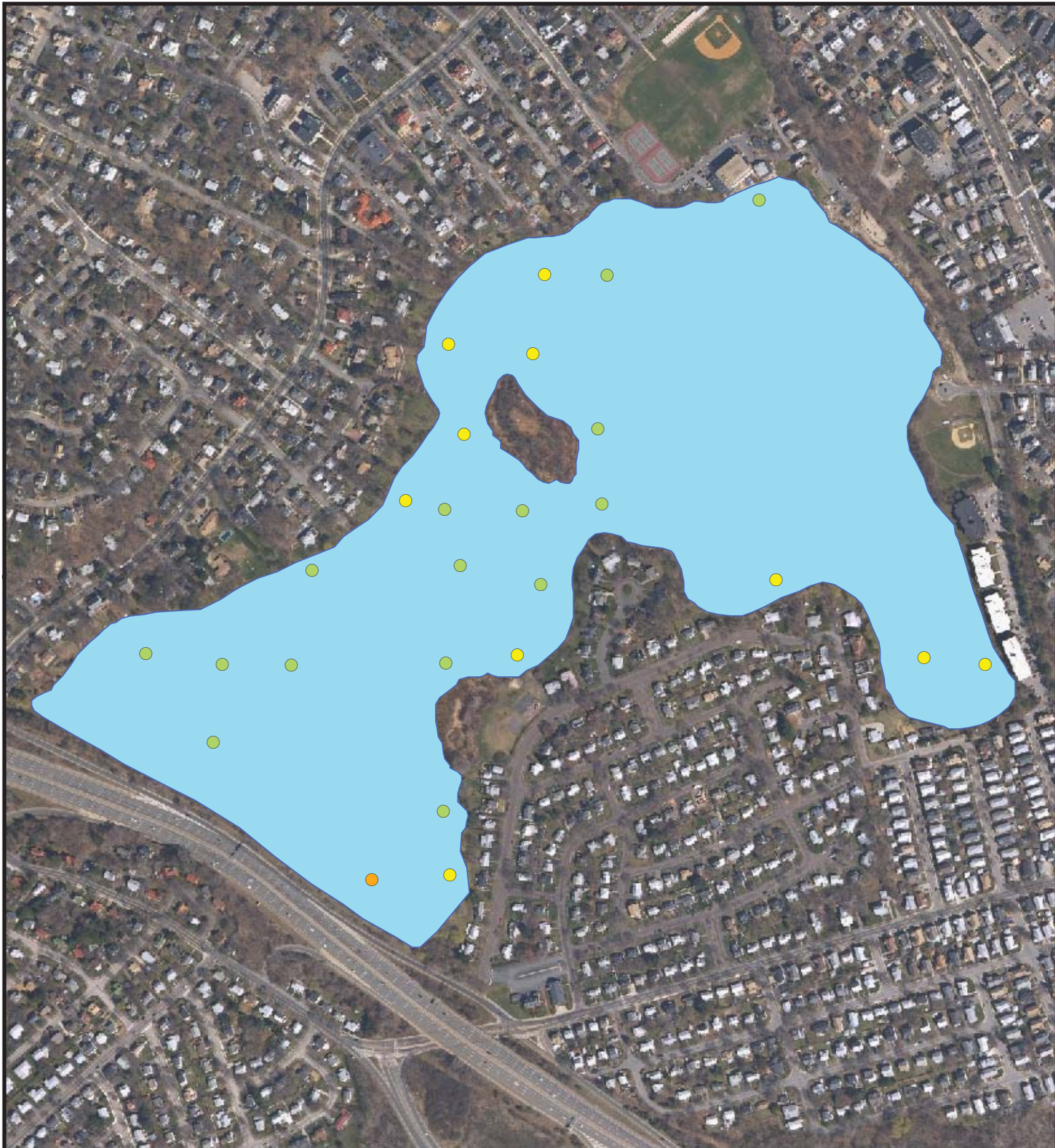
- Biomass 1
- Biomass 2
- Biomass 3
- Biomass 4



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FIGURE:	SURVEY DATE:	MAP DATE:
32	8/31/07	12/14/07



Spy Pond

Arlington, Ma

Myriophyllum spicatum Coverage Map

Legend:

- 1%-25% cover *Myriophyllum spicatum*
- 26%-50% cover *Myriophyllum spicatum*
- 51%-75% cover *Myriophyllum spicatum*
- 76%-100% cover *Myriophyllum spicatum*



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FIGURE:

33

SURVEY DATE:

8/31/07

MAP DATE:

12/14/07



Spy Pond

Arlington, Ma

Potamogeton pusillus Coverage Map

Legend:

- 1%-25% cover *Potamogeton pusillus*
- 26%-50% cover *Potamogeton pusillus*
- 51%-75% cover *Potamogeton pusillus*
- 76%-100% cover *Potamogeton pusillus*



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FIGURE:

34

SURVEY DATE:

8/31/07

MAP DATE:

12/14/07

Locations of Filamentous algae

- 1%-25% cover
- 25%-50% cover
- 51%-75% cover
- 76%-100% cover

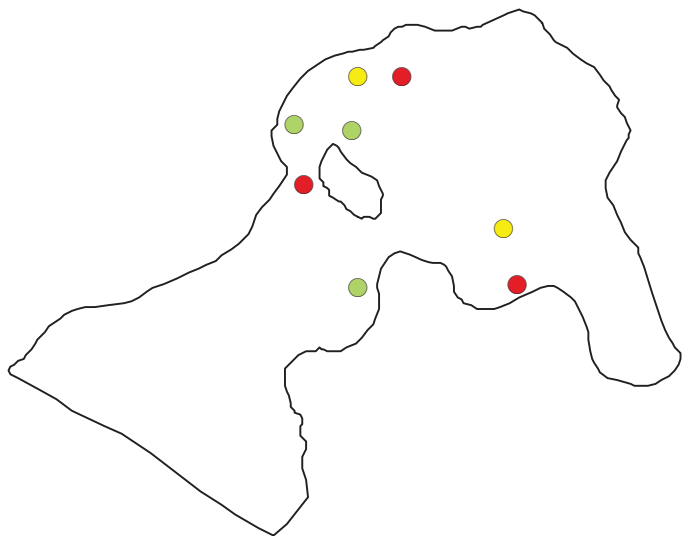


Figure 35

Locations of *Najas flexilis*

- 1%-25% cover
- 25%-50% cover
- 51%-75% cover
- 76%-100% cover



Figure 36

Locations of *Nitella* sp.

- 1%-25% cover
- 25%-50% cover
- 51%-75% cover
- 76%-100% cover



Figure 37

Locations of *Phragmites australis*

- 1%-25% cover
- 25%-50% cover
- 51%-75% cover
- 76%-100% cover

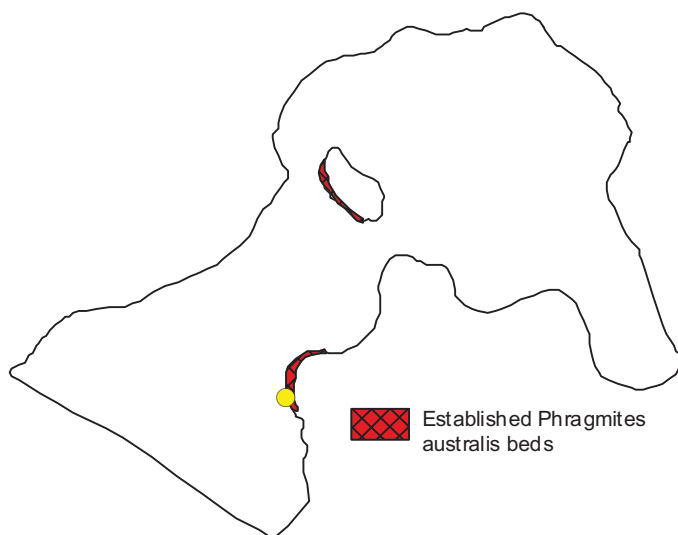


Figure 38

Spy Pond

Data Point #	LAT	LONG	Water Depth	Sediment Type	Biomass	Total Cover	Ms	Pp	Fa	Nf	Ni	Phrag
1	42.41136488	-71.15204081	13.4	M/S	2	5	5					
2	42.41050053	-71.15091118	27.3	M	0	0						
3	42.41052878	-71.15207023	27.3	M	0	0						
4	42.41057681	-71.15317421	24.3	M	0	0						
5	42.41057304	-71.15418901	8.3	M	2	110	10		100			
6	42.4105955	-71.15508788	6.5	M	3	90	40		50			
7	42.40985865	-71.15644399	7.2	M	3	40	30		10			
8	42.40976058	-71.1552515	7.6	M	2	50	40		10			
9	42.40978606	-71.15414953	21.4	M	0	0						
10	42.40973535	-71.15313909	29.4	M	0	0						
11	42.40972504	-71.15198784	38.9	M	0	0						
12	42.4098423	-71.15075829	33	M	0	0						
13	42.40971842	-71.14974719	18.3	M	0	0						
14	42.40907829	-71.15093716	29.8	M	0	0						
15	42.40900151	-71.15213016	29.9	M	0	0						
16	42.4091171	-71.15323967	32.3	M	0	0						
17	42.40897218	-71.15433477	16.5	M	2	5	T	T				
18	42.40891753	-71.15623034	4.6	M	3	120	40		80			
19	42.40822434	-71.15705788	4.1	M	3.5	60	50	10				
20	42.40813516	-71.15650862	5.5	M	2.5	40	20	10		10		
21	42.40810934	-71.15540707	5.2	M	2.5	75	25	50				
22	42.40818109	-71.15428867	7.5	M	2	60	10	50				
23	42.40823457	-71.15319072	27.6	M	0	0						
24	42.40822996	-71.15208942	4.5	M	3	150		100	50			
25	42.40821001	-71.15095535	28.6	M	0	0						
26	42.40811639	-71.14986579	22	M	0	0						
27	42.40734567	-71.14974769	24.2	M	0	0						
28	42.40738079	-71.15183109	5.5	M	2	170	30	40	100			
29	42.40733854	-71.15514454	5.6	M	2.5	45	25		20			
30	42.40754189	-71.15630032	6.2	M	2	30	20	10				
31	42.40735598	-71.15740523	14.4	M	0	0						
32	42.40748707	-71.15839664	6.5	M	3	30	25			T		
33	42.40663296	-71.1607403	9.8	M	1	10	10					
34	42.40651913	-71.15966482	5.2	M	2	15	15					
35	42.40649499	-71.15869009	7.3	M	2	10	10					
36	42.40663748	-71.15761955	16.3	M	0	0						
37	42.40651703	-71.15649076	4.5	M	2	40	20	10		10		
38	42.40660058	-71.15548627	3.4	M	4	100	50	50				
39	42.4065592	-71.14974006	4.6	M	2.5	50	50					
40	42.40648577	-71.14886642	5.1	M	3.5	45	45					
41	42.40568882	-71.15665765	6	M	4	50						50
42	42.40565152	-71.15753414	20.1	M	0	0						
43	42.40568653	-71.15859982	18.6	M	0	0						

Spy Pond

Data Point #	LAT	LONG	Water Depth	Sediment Type	Biomass	Total Cover	Ms	Pp	Fa	Nf	Ni	Phrag
44	42.40569653	-71.15979273	8.2	M	3	25	25					
45	42.40572637	-71.16071943	12.2	M	0	0						
46	42.40602753	-71.16181687	17.2	M	0	0						
47	42.40487527	-71.15871448	19	M	0	0						
48	42.40495406	-71.15770035	20	M	0	0						
49	42.40496663	-71.15653787	4.5	S	1	15	15					
50	42.40430404	-71.15646453	3.5	M	4	40	40					
51	42.40424847	-71.15756666	6.2	M	3.5	65	60				T	
			14.4		1.4	27.4*						
						Frequency	51.0%	19.6%	15.7%	5.9%	2.0%	2.0%
						Count	26	10	8	3	1	1

Temperature Dissolved Oxygen Profiles		
7/31/2007		
Depth (m)	Temp (c)	DO
S	28.3	9.66
1	27.6	9.62
2	27.1	9.32
3	25.4	9.56
4	24.5	9.12
5	22.3	11.48
6	17.9	8.02
7	13.7	9.35
8	14.0	6.43
9	12.5	1.08

9/4/2007		
Depth (m)	Temp (c)	DO
S	26.4	9.55
1	26.4	9.76
2	25.5	10.03
3	24.9	11.46
4	23.2	10.66
5	22.0	10.19
6	18.2	6.26
7	15.1	0.36
8	12.2	0.23
9	9.8	0.21

Parameter	Unit	Station 1 - Surface		Station 1 - 5M		Station 2 - Surface		Station 2 - 8M		Average
		7/30	9/4	7/30	9/4	7/30	9/4	7/30	9/4	
pH	S.U.	8.76	8.56	6.71	7.02	8.64	8.52	7.85	8.52	8.07
Alkalinity	CaCO3/L	39.0	39.0	47.0	38.0	41.0	38.0	43.0	48.0	41.63
Turbidity	NTU	2.0	0.85	0.98	0.85	1.90	1.00	2.00	0.90	1.31
Total Kjeldal Nitrogen	mg/L	0.86	0.43	2.10	0.50	0.66	0.54	0.71	0.67	0.81
Ammonia Nitrogen	mg/L	<0.05	<0.05	1.05	0.11	<0.05	<0.05	0.89	0.05	0.28*
Nitrate	mg/L	1.10	0.25	1.00	0.22	1.10	0.25	1.00	0.11	0.63
Total Phosphorus	mg/L	0.014	0.018	0.038	0.042	0.020	0.021	0.029	0.055	0.03
Dissolved Phosphorus	mg/L	<0.010	<0.010	0.010	0.018	<0.010	<0.010	<0.010	0.011	0.011*
True Color	Pt-Co	5	5	5	5	5	5	5	10.00	5.63
Apparent Color	Pt-Co	10	15	10	17	8	15	15	15.00	13.13
E.coli	CFU/100ml	<10	<10	<10	<10	<10	<10	<10	<10	<10

APPENDIX H



TOWN OF ARLINGTON

M A S S A C H U S E T T S

Arlington Reservoir **DAM** REHABILITATION **PROJECT** **2006**

RECIPIENT

**APWA
2006
PUBLIC WORKS
PROJECT OF
THE YEAR**

RECIPIENT

**ACEC/MA
2006
ENGINEERING
EXCELLENCE
AWARD**

TOWN MANAGER

BRIAN F. SULLIVAN

DPW DIRECTOR

JOHN G. SANCHEZ

BOARD OF SELECTMEN

**KEVIN F. GREELEY, CHAIR
ANNIE LACOURT, VICE CHAIR
JOHN W. HURD
DIANE M. MAHON
CLARISSA ROWE**

ENGINEER

WESTON & SAMPSON ENGINEERS, INC.
PEABODY, MASSACHUSETTS

GENERAL CONTRACTOR

MIG CORPORATION
ACTON, MASSACHUSETTS

ARLINGTON RESERVOIR DAM PROJECT

Winner: Public Works Project of The Year for 2006, American Public Works Association

Winner: Engineering Excellence Award 2006, American Council of Engineering Companies of MA

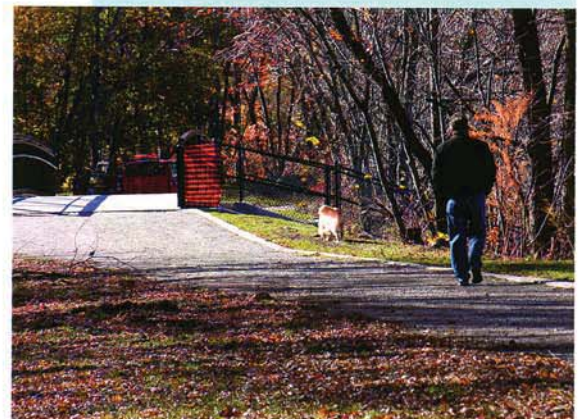
PROJECT BACKGROUND

In the mid 1990s, the aging mechanical crest gate in the Primary Spillway of the Arlington Reservoir Dam failed, causing flooding in the downstream residential area of Colonial Village. Following a subsequent dam safety inspection, the Commonwealth of Massachusetts ordered the Town of Arlington to repair its aging dam. The Town of Arlington turned to Weston & Sampson to find a safe, economical solution for rehabilitating the structure, all under the watchful eye of residents who were adamant that the forested landscape and habitat of this popular recreational site in this residential neighborhood remain unchanged. Weston & Sampson's challenge was to reconcile the project's competing goals.

The Arlington Reservoir (Res) Dam consists of approximately 1,600 feet of 12-foot high earth embankments extending from two centrally located spillways. The dam was constructed in the 1870s to create a drinking water supply reservoir for the Town of Arlington, Massachusetts. The reservoir has not served as a water supply for over a century, but is a significant recreational feature within an active suburban neighborhood. As with many dams built during the industrial revolution, the embankments were overgrown with trees and other vegetation and there were areas where seepage through the embankments was evident. In addition, the hydraulic capacity of the dam was significantly undersized by current standards.

Weston & Sampson's original design included tree removal from the earthen embankment in accordance with traditional dam safety guidelines. However, the design encountered significant opposition from residents who use the dam for passive and active recreation, including walking, jogging, and bird watching. Removing all the trees that line the berm was completely unacceptable to the residents of Arlington. This opposition, forced the project's postponement for a few years.

In 2002, the project was revived as the town realized its obligation to rebuild the dam. Weston & Sampson had the unique opportunity to implement a dam rehabilitation engineering solution that had only been used once before in the United States. With the project at an impasse because of resident opposition to tree removal, Weston & Sampson identified a "win-win" solution based on a precedent set by a U.S. Army Corps of Engineers project in the Midwest. Using this innovative technology, Weston & Sampson designed a vertical interlocking steel sheetpile wall capped with a reinforced concrete beam (I-Wall) for installation along the length of the dam, including below the existing and new spillways. The I-Wall permitted the majority of trees to remain while protecting against dam breaching and uncontrolled seepage through the embankments.



ARLINGTON RESERVOIR DAM PROJECT

Winner: Public Works Project of The Year for 2006, American Public Works Association

Winner: Engineering Excellence Award 2006, American Council of Engineering Companies of MA

INNOVATIVE APPROACH

The Res Dam rehabilitation is the first dam repair project completed in the eastern half of the United States (U.S.) to use the I-Wall approach. The only other U.S. project to use this technique was implemented by the Army Corps of Engineers on the Pine River Dam at the headwaters of the Mississippi River in Minnesota.

Similar to the Res Dam project, there was strong opposition to tree removal on the Pine River Dam. The position of most dam safety regulatory agencies is that trees should not be allowed to grow on earthen dams for a variety of reasons. Given this regulatory position, approval of this project required extensive discussion and collaboration with the Massachusetts Office of Dam Safety to educate them on the I-Wall's functions relative to dam safety and to assure them that this technique was constructible at the Res Dam site.

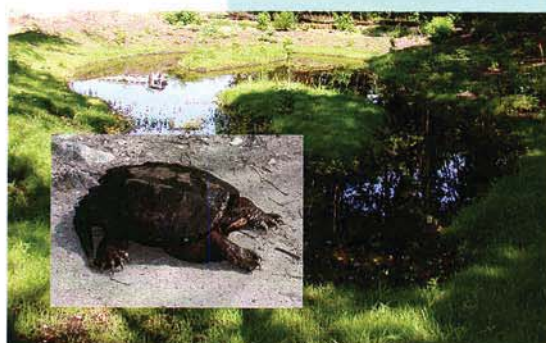
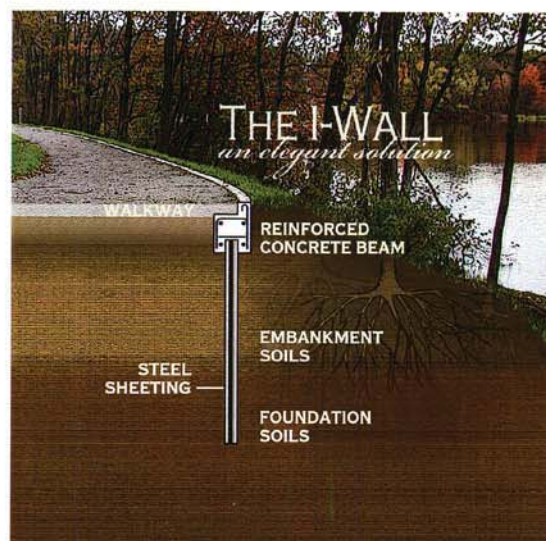
ENVIRONMENTAL CONSIDERATIONS

The Res Dam Rehabilitation project offers the engineering community a new alternative to dam repair that can sustain a forested landscape while avoiding the time and expense of environmental permitting. Implementing the I-Wall solution also avoided the environmental and aesthetic impacts associated with removing trees, some as large as 24 inches in diameter, both upstream and downstream of the 1,600-foot long embankment.

Without the use of the innovative I-wall approach, thousands of trees would have been destroyed, leaving a barren embankment with rock covered slopes extending almost the entire length of the reservoir – all in the middle of an active urban residential neighborhood. Weston & Sampson's alternative solution displaced only 150 trees of more than five inches in diameter. **"Nobody could imagine losing all of these trees,"** said Leslie Mayer, co-chairman of Vision 2020's Reservoir Committee. **"From a recreational aspect and a habitat aspect, it really would have destroyed it."**

The project also maintained the wildlife habitat, including its resident turtle, within this urban neighborhood. According to Reservoir Committee member Elizabeth Karpati, more than 130 species of birds frequent the reservoir, including great blue heron and sandpipers that nest in the mudflats. She said they would have become sparser with disruptions to the surrounding vegetation. The Arlington 2020 web site described the project's progress as **"a major accomplishment for a technique that hasn't been employed in this area of the country. And the good news on the environmental impact — there are trees and wildlife everywhere!! ... The Reservoir will continue to be an Arlington gem for many years!"**

Aside from gaining widespread public acceptance, this innovative approach, which spares the time and cost of extensive environmental permitting while maintaining natural landscapes, will be especially important for Areas of Critical Environmental Concern (ACEC).



ARLINGTON RESERVOIR DAM PROJECT

Winner: Public Works Project of The Year for 2006, American Public Works Association
Winner: Engineering Excellence Award 2006, American Council of Engineering Companies of MA

ADDITIONAL BENEFITS

While the Res Dam redesign was not intended necessarily as a flood control project, operation of the Primary Spillway has always played a role in flood mitigation in downtown Arlington. The spillway gate is opened in advance of storms to increase storage capacity then closed to contain water in the reservoir until flooding from other sources has subsided. At that point, the gate is incrementally opened to release the contained water in a controlled manner. In the mid 1990s, the old gate failed and the reservoir water was released all at once flooding the downstream area and causing substantial damage. The operation of the reservoir for flood control was severely impacted. The new and improved gate is stainless steel and has an updated operating mechanism making gate operation for flood control and reservoir level management much simpler and effective.

Perhaps best of all, and somewhat unexpected, was a substantial cost savings in construction cost. Because construction activities in wetland resource areas were limited to work around the spillways, the wetland impacts of the project were dramatically reduced resulting in significant cost and time savings with regard to environmental permitting. Significant savings were also realized by not excavating hundreds of trees and roots, reshaping the embankment slopes, and installing riprap protection. The original 2001 estimated construction cost was \$2.2 million for the traditional dam repair option. The actual 2005 cost was \$1.6 million, saving the town \$600,000.

This project demonstrates the successful balance of public health and safety with public interests and environmental issues. Weston & Sampson's solution is a "win-win" with its resistance to breaching failure, significant reduction in dam seepage, thereby protecting Arlington, and the aesthetic and recreational value of the site preserved, thereby sustaining the natural environment.

John Sanchez, Arlington's Director of Public Works, praised Weston & Sampson for developing an innovative solution that protected Arlington from devastating flooding while saving the trees and sustaining the natural environment. **"This was a great compromise,"** he said in a recent article published in the Lexington Minuteman.

AWARDS

The Arlington Reservoir dam project was recently selected as one of the American Public Works Association's **Public Works Projects of the Year for 2006**. This national award will be presented in September at the 2006 International Public Works Congress and Exposition in Kansas City, Missouri. In addition, the project was selected by the American Consulting Engineers Council of Massachusetts (ACEC/MA) to receive a **2006 Engineering Excellence Award**. These prestigious awards honor projects that achieve professional design excellence and innovation.

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Weston & Sampson
ENGINEERS, INC.

APPENDIX I

Town of Arlington

FINAL REPORT

ADA Self-Evaluation (as basis for Transition Plan)

Prepared by
Institute for Human Centered Design
December 15, 2014



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Water-Based Sports

The Arlington Reservoir Beach programs are, at this time, largely inaccessible due to structural accessibility barriers within program areas. Programs include seasonal beach tags for families and individuals; and certified (American Red Cross) swimming lessons. The Beach programs are site specific and this location is also an important place for local social gatherings and neighborhood bonding. Families and small groups can rent program areas for seasonal birthday party rentals.⁴ Families and individuals can purchase a beach tag to enjoy community gatherings, such as a Moonlight Beach Party Benefit co-sponsored by the Arlington Recreation Department and the Arlington Parks Alliance.⁵ The Beach is also used for the Summer Exploration Club swims (ages 10 - 14).

At this time, the Department has already been gathering feedback to inform the scoping of capital improvements at Reservoir Beach. IHCD would like to commend the inclusion of an accessible route from the parking facility along Lowell to the beach; other improvements are also included that will improve the quality of structural accessibility conditions at beach programs. Part B uses the Reservoir Beach as a case study for recommendations on how to use site management procedures to prevent non-complying alterations.

⁴ http://www.arlingtonma.gov/Public_Documents/ArlingtonMA_Recreation/birthdays/resbirthdays ⁵ "The Arlington Parks Alliance is made up of representatives from the community and local Friends groups that work collaboratively to assist the Park and Recreation Commission's efforts to preserve, protect, restore and enhance the 27 parks and playgrounds in Arlington. *For more information about the Arlington Parks Alliance (APA), contact www.arlingtonparks.org.*"
http://www.arlingtonrec.com/info/activities/program_details.aspx?ProgramID=29060 ⁶ The U.S. Access Board has a number of online guides available, see:
<http://www.accessboard.gov/attachments/article/589/boating.pdf> AND
<https://www.dnr.sc.gov/marine/NERR/present/accessibility/RecreationalBoatingFacilitiesFishingPiersPlatforms.pdf>
Where public information is disseminated about this program, an accurate description of the accessibility conditions at these programs should be included in public information as a standard operating procedure.

Walking Trails

Within this inventory, at least nine facilities include walking trails that were re-graded and paved within the past decade, resulting in excellent programmatic additions to the Department's unique offerings. These include access to natural beauty and quiet places off the beaten path and close to water's edge at ponds, brooks, marshy and woody areas, large open grassy fields and beaches. Where there is no accessible pathway off the interior walkways leading to these programs, we find picnic tables, gardens, benches, and play areas out of accessible reach, because ground surfaces are grassy rather than smooth, or contain surface materials which do not maintain stable grades and consistent firm, level and slip-free surfaces. Specific to walking surfaces, the U.S. Department of Interior National Park Services Office of Civil Rights finds pea gravel and other small particle surfaces to not meet the requirements for firm, stable and slip-resistant surfaces.¹

¹ See recent U.S. DOI Civil Rights Directive: Policy for Implementing a Public Civil Rights Program, June 25, 2009. This is online at: <http://www.doi.gov/pmb/eeo/directives/upload/PCR-CR-2009-01.pdf> ⁸

As the Recreation Department and Park and Recreation Commission continue to manage Capital Improvement projects in collaboration with other Commissions and engaged resident stakeholders, some of these beautiful and large parks will continue to be developed with secondary and additional paths. The Department is advised to become familiar with the Federal standards for Outdoor Developed Areas, which address access to trails, picnic and camping areas, viewing areas, beach access routes and other components of outdoor developed areas. While these requirements are not yet requirements for Title II entities, there is continuing movement in that direction. More information regarding The U.S. Access Board standards for Outdoor Developed Areas is included in Part D – Appendices.⁸ There are also excellent guidance resources on Recreational Trail Program development from the Federal Highway and Department of Transportation's accessibility pages.⁹ Please see further discussion on outdoor facilities (passive recreational facilities, walking trails) in Part A - Executive Summary, findings by program type in Part B, and the element-by-element surveys and recommendations in Part C - Evaluation of Facilities.

Where public information is disseminated about this program, a best practice recommendation is to include links to information rating trail difficulties, and providing trail measurements and accessibility conditions, where such information has been compiled as part of the site management, development of shared-use paths, and existing conditions evaluations completed during the design phase of trail and shared-use path improvements. The Department is encouraged to evaluate existing conditions as a standard operating procedure during the planning and scoping phase of Capital Project management practices.²

Community Gardens

There is also the Wildlife habitat garden area between the Reservoir Trail and the back entry to Hurd Field. Although the intent was to make the Habitat garden accessible, the effort has not yet succeeded. This excellent effort involved a Town Department working with local stakeholders and resulted in two re-graded areas – the Meadow and the Shade Gardens. As stakeholders continue developing this community and environmental educational asset, there should be considerations for bringing the signage closer to a level graded area; and planning for at least one least steep pathway, perhaps with a natural materials fence or half-wall to enable a larger involvement of residents with disabilities who are gardeners and may be gifted and interested in environmental stewardship of the natural assets around the Arlington Reservoir.

The Learning Garden, Wildlife Habitat and Community Garden programs hold the potential to exploit the wind and water along with the land as they continue to be designed and developed. Where public information is disseminated about this program, an accurate description of the accessibility conditions at these programs should be included in public information as a standard operating procedure.

Off-Leash Dog Recreation Programs

<http://www.access-board.gov/guidelines-and-standards/recreation-facilities/outdoor-developed-areas> ⁹

http://www.fhwa.dot.gov/environment/recreational_trails/guidance/accessibility_guidance/

² This practice can also inform the Department's collaboration with the State when reviewing and improving the Town's asset management of Arlington's Minuteman Trail links. For resources please see <https://www.imba.com/resources/maps/trail-difficulty-ratings>

In the Spring of 2010, the Town residents approved a by-law to allow off-leash dog walking at certain parks. Thirteen facilities in the survey have off leash walking hours in the early morning. Since then, an Off-Leash Recreation Area (OLRA) was developed adjacent to Thorndike Field.

Program accessibility issues involve information, communications and physical access. Signage along paved walkways is not uniformly at an accessible height and not consistently approachable along an accessible route. Communications issues also involve the need to provide information for how to request OLRA and Off-Leash Dog Walking hours in alternate formats. In conversations with the Department Director and Park and Recreation Commission members, it is clear that consideration for how to better enable individuals using Service Dogs to take advantage of this excellent recreational opportunity is an emerging focus issue. Other recommendations include providing a smooth ground surface for the interior walkway in the Thorndike OLRA; this will solve issues regarding ease of maneuvering these paths, and help eliminate tripping and tumbling risks associated with small particle ground surface materials. The Thorndike OLRA requires accessible walking surfaces and other components of accessible routes to be provided as a crucial part of the mitigation plan for these programs; these physical condition standards apply to the routes from public transit, nearby streets and sidewalks, and municipal parking facilities that support the implementation of these public programs. In addition, details such as the provision of clear, level space and seating locations for individuals using wheeled mobility devices, canes, etc. will ensure that integrated seating amenities and social opportunities are provided around park trees and at bench locations.

Parking Facilities

The survey also included off-street parking facilities supporting the programs and functions at 16 facilities. Most parking facilities provide an adequate number of accessible parking spaces and access aisles (stripped areas alongside accessible parking spaces) with compliant widths and lengths; however, slopes of parking space access aisles and adjoining crosswalk areas are excessive. Accessible route connections between accessible parking spaces and the points of entry to the facility they serve have excessive cross and run slopes, inaccessible curb ramps and sidewalks, uneven ground surface issues; and, in some cases were missing. Recommendations for parking facilities by program type are grouped in Part A - Executive Summary of Facilities, Structural Accessibility section. ; Detailed facility survey reports along with overall facility recommendations for these sites are provided in Part C - Evaluation of Facilities.

Playgrounds

Many playgrounds were constructed or altered since the ADA Architectural Standards became effective with the 1990 ADA Standards in January 26, 1992. In particular, the Locke School Park and Playground renovations, completed around 2004, achieved excellent consistency with program accessibility objectives and this facility now requires only minor modifications to continue being a lovely and intimate neighborhood place that offers inclusive leisure and play opportunities combined with pleasantly landscaped shady and sunny areas.

The majority of playgrounds had the following two issues at one or more play areas:

1. A border fully encloses the play area which creates a change in level between inside and outside the play area. Therefore, there is no independent accessible entry/exit opening or accessible route between play areas and the rest of the facility areas, elements and amenities.
2. Play areas have inaccessible ground surfaces, including uneven slopes, lack of accessible cross slopes, holes, protrusions, and depressions. In general, this is found where loose fill surface materials are utilized. These materials have been found to require high maintenance and frequent replenishment to maintain accessible slopes. In addition, studies have proven that loose fill materials are not easy for wheeled mobility users to move around in.

Those repeated issues apply to the following 14 playground locations:

- Bishop Field: two play areas;
- Buzzell Field: one play area;
- Crosby School / Tennis Courts: one large play area;
- Cutter School / Reinhart Park: one play area;
- Gibbs Gym: two play areas adjacent to school and open to public after school hours;
- Reservoir Beach: three play areas;
- Magnolia Park: one play area;
- Menotomy Rocks Park: one play area;
- Parallel Park: one play area;
- Parmenter: one play area;
- Pheasant Avenue Park / Greeley Playground: one play area;
- Poet's Corner: one play area;
- Robbins Farm: two play areas plus Long Slide (entry to Slide is not accessible);
- Spy Pond Park: one play area;
- Waldo Park: two play areas.

Recommendations, without much difficulty or expense:

- 1) Add an accessible entry/exit to each recessed or sandy play area within facility by installing a ramped entry or a level entry to both recessed playground. Project completion objectives should include:

Each play area will be connected to at least one accessible walkway that connects with other park and playground programs and amenities, including benches, picnic areas, other sports activities, and at-grade entrances to facility.

- 2) Provide an accessible Route within play area using one or both of the following methods:

- a) Using high-frequency maintenance programs as a method of achieving program access. If only loose fill ground surface materials are used, implement a high-frequency maintenance program to ensure accessibility of ground surface materials through all seasons.
- b) Using replacement of ground surface materials as a method of achieving program access. If ground surface materials will be replaced: consider adding unitary surface materials within the playground areas to provide accessible routes and clear ground spaces to all entry/exit points of ground play elements, including swingsets, play structure transfer station, and ground play elements.

Regardless of which method is used, Play Area Accessible Route Project completion objectives should include:

Each accessible play element and composite play structure element will be connected to all other accessible entry and exit points within the play areas; and will be linked with all other program areas, elements and amenities (including benches, picnic areas, portable toilets, drinking fountains, spectator areas, team playing areas, team meeting areas) in addition to the facility's at-grade entrances.

Parking Facilities

Most parking facilities provide an adequate number of accessible parking spaces and access aisles with compliant widths and lengths; however, cross slopes of parking space access aisles and adjoining crosswalk areas are excessive. Accessible route connections between accessible parking spaces and the entry points of the facility they serve were found to have excessive cross and run slopes, inaccessible curb cuts and sidewalks, uneven ground surface issues which results in unusable and inaccessible facilities.

Findings:

The following parking facilities did not include marked accessible spaces and access aisles, where at least one accessible space with access aisle is required at a location as near as is practicably possible to the facility programs:

- Buck Field / Hill's Hill (Sports Complex);
- Pheasant Avenue Park / Greeley Playground;
- Reservoir Beach;
- Summer Street Park.

Recommendations, without much difficulty or expense:

- Install the required parking signs;
- Provide at least one van-accessible space closest to the combined facility entrance;

Recommendations, Capital Project:

- Construct an accessible route, including curb ramp, joining accessible parking spaces to the sidewalk route leading to the ballfield bleachers, team clubhouse, and dugout areas.
- Connect all programs, such as the playground and picnic areas, perimeter of field playing areas, bleachers inside the facility, and all field gates inside facility with the exterior accessible route from accessible parking space(s) to the combined facility entrance;
- Re-grade parking area to not exceed 1:48 cross slope in all directions.

Prioritizing Accessibility Modifications – Recommended Order of Considerations:

This ADA Compliance Study was contracted by the Town's Recreation Department and Park and Recreation Commission in order to prepare a Self-Evaluation that will be the basis of an ADA Transition Plan in order for the Department and Commission to create a planning and budgeting strategy to comply with the requirements of the American with Disabilities Act of 1990 (ADA), including modifications made by the ADA Amendments Act of 2008; and incorporating the scoping and technical requirements as set forth in the 2010 ADA Standards for non-compliant existing facilities that will be altered and for new construction.

The Department of Justice provides a non-exhaustive list of considerations for determining program access priorities where a similar program may be offered at multiple sites. Such factors include: The size of the public entity, the particular program features offered at each site, the geographical distance between sites, the travel times to the sites, the number of sites, and availability of public transportation to the sites. Additional factors specific to existing accessibility conditions include²¹:

- Availability of accessible pedestrian routes to the playgrounds;
- Ready availability of accessible transportation;
- Comparable amenities and services in and surrounding the play areas;
- Size of the playgrounds;
- Sufficient variety in accessible play components within the playgrounds.

Recommended priority considerations are tailored to assist the Recreation Department and Park and Recreation Commission in developing large and smaller capital improvement projects in order for the Department and the Town to achieve its program accessibility objectives under Title II of the ADA. The development of this plan is part of the Town and Department's ADA administrative mandates²². Specifically, the Department is required to complete an ADA Self Evaluation (this report) as a prerequisite to developing what is known as the ADA Transition Plan. The ADA transition plan must include a schedule for providing access features, including curb ramps for walkways.²³ The transition plan will accomplish the following four tasks:

- Identify physical obstacles in the public agency's facilities that limit the accessibility of its programs or activities to individuals with disabilities;
- Describe in detail the specific corrective action that will be used to make the facilities accessible;

- Specify the schedule for taking the steps necessary to upgrade pedestrian access to meet accessibility requirements in each year following the transition plan;
- Indicate the official responsible for implementation of the plan by name.

²¹ These factors were suggested by individuals with disabilities who provided user-expert comments to the Department of Justice after reviewing the draft regulations and prior to their adoption.

²²²²

Please see Part B- Evaluation of Program Policies, Practices and Procedures for further discussion of the Department's 5 administrative mandates, including the ADA Self-Evaluation and Transition Plan ²³ 28 CFR §35.150(d)(2) Also see Part A, Legal Requirements-- Joint Requirements, DOJ and DOT, Street & Road Resurfacing. Using the results from this ADA Self-Evaluation as a foundation, the Department and Commission must develop the Transition Plan through an iterative process involving public meetings and in concert with all associated stakeholders.

Programs must be offered in a manner that is congruent with the principles of Title II of the ADA. The ADA's program accessibility requirement is to make each of the programs, *services, and activities, when viewed in their entirety*, readily accessible to and usable by people with disabilities. *Each of the programs, services, and activities when viewed in their entirety* is the phrase that qualifies the analysis of program accessibility requirements.

In achieving program accessibility compliance, the Recreation Department is obligated to conduct the inspection of facilities in order to assess to what extent the structural and communications accessibility standards are being met to ensure the achievement of program accessibility standards.

Suggested order of Priorities

Under those overarching Title II requirements, the program³ analysis can be categorized and combined in various ways, depending on the Department's overall needs and objectives against the backdrop of the Department's and Commission's legal obligations and responsibilities. IHCD analyzed the Department's programs as a whole, then the programs being offered at each facility as a whole, and then the separate programs being offered at each facility within the context of transportation and neighborhood. This analysis yielded the following six categories in order of suggested priorities:

- 1) Unique Programs which are associated with revenue and registration;
- 2) Unique Programs which may or may not be associated with fees, but are public programs not duplicated elsewhere within the Department's facility portfolio;
- 3) Facilities which include programs managed and overseen by the Recreation Department in collaboration with other Town Departments;

³ For purposes of simplicity, the term "programs" will be used in this section to cover the Department's ADA program obligations pertaining to programs, services, activities, events, opportunities, benefits, aids, and assistance that are named in Departmental information as being provided to the public by Arlington Recreation. The information that was reviewed included the publicly disseminated seasonal brochures, the Town of Arlington Recreation Department website at <http://www.arlingtonma.gov>, and the Arlington Recreation Activities information at <http://www.arlingtonrec.com>

- 4) Programs which offer unique location-specific elements that are not duplicated at other similar programs;
- 5) Programs that are provided at locations that also offer multi-modal transportation options;
- 6) Programs within areas of Town that would be underserved with regards to that particular program if the residents were not provided proximate availability of that program.

Prioritized facilities listed below require mitigation of program barriers; have programs that are site specific (i.e., cannot be relocated without altering the fundamental nature of the programs being provided on that site); can solve some or all of these issues with minor or major accessibility renovations; and also include portions that are considered noncomplying elements because they were constructed or altered not in accordance with the Federal and/or State standards in effect at the time of construction.:

1) Unique programs which are associated with revenue and registration

The following facilities provide fee-based and rental opportunity programs; and the Department collects applicant and registration information from individual participants and non-municipal agencies, organizations, and teams. Along with the necessary structural and communications modifications to ensure that these programs are provided in a minimally accessible manner, the Department must also ensure that accurate information regarding accessibility features (or not) is provided up front so that participants and rental organizations can determine if these programs are currently *readily available*:

- Ed Burns Arena and Sports Complex (includes Summer Street Park / Buck Field / Hill's Hill);
- Gibbs Gym;
- Spy Pond Park;
- **Reservoir Beach.**

2) Facilities that include programs managed and overseen by the Recreation Department in collaboration with other Town Departments

Outdoor Facilities:

- W.A. Peirce Fields: Baseball, Football, Field Hockey, Lacrosse, Soccer, Softball, Outdoor Track, Cross Country;
- **Reservoir: Cross Country;**
- Buzzell Field: Softball;
- Crosby School / Tennis Courts: Tennis (Boys, Girls)
- Wellington Park: Tennis (Boys, Girls)
- Dallin School Field: Lacrosse;
- Lussiano Field: Baseball, Softball;

- Spy Pond Field: Baseball, Soccer;
- Thorndike Park & Magnolia Field – Soccer (Boys, Girls), Lacrosse;
- Summer Street Park – Baseball, Field Hockey.

3) Programs that offer unique location-specific elements that are not duplicated at other similar programs

- Florence Park: model accessible playground, zip line, accessible game table;
- **Hurd Field**: parking facility outdoors lights, **connection with trails and beach**;
Summer Street Park: intergenerational play area, fitness route;
- Wellington Park.

4) Programs within areas of Town that would be underserved with regards to that particular program if the residents were not provided proximate availability of that program.

Examples of such proximity issues include areas where subsidized housing is offered to distinct types of underserved populations, including low-income older residents, and individuals with disabilities. For example, Cusack Terrace, a housing development specifically for older and disabled residents, is located near Buzzell Field and facilities along the Minuteman Commuter Bikeway trails. The Drake Village Complex is another such example, and is located near **Hurd Field / Reservoir** and the Minuteman Commuter Bikeway trails.

The analysis of suggested priorities 6) and 7) are also based upon neighborhood proximity. For example, when choosing which playground to renovate next, the Department may look at the portfolio while considering which neighborhoods are not currently being served by accessible playgrounds.

Facilities in Arlington Heights (9 total):

- McClennen Park;
- Peirce School Park;
- **Reservoir Beach**;
- Hurd / Reservoir;
- Locke School Playground;
- Ottoson Field / Crusher Lot;
- Florence Avenue Park;
- Hibbert Street Park;
- Poet's Corner.

Legal Overview

The Town of Arlington is obligated by both Federal and State laws and codes concerning the rights of people with disabilities in the daily provision of programs, services, and activities. This 'Legal Overview' offers a brief explanation of Federal and State Obligations:

Federal Obligation: American with Disabilities Act

Based on the 1964 Civil Rights Act and expanding upon the obligations of the 1973 Rehabilitation Act, the ADA prohibits discrimination against people with disabilities. The ADA provides civil rights protections to individuals with disabilities similar to those afforded to individuals on the basis of race, color, sex, national origin, age, and religion. The cornerstone of Title II of the ADA, which applies to state and local governments, is clear: no qualified person with a disability may be excluded from participating in, or denied the benefits of, the programs, services, and activities provided by state and local governments because of a disability. The ADA defines a disability as⁴:

- A physical or mental impairment that substantially limits one or more major life activities (i.e. working, talking, hearing, seeing, caring for one's self);
- Having a record of a physical or mental impairment that substantially limits one or more major life activities;
- Being regarded by others as having an impairment such as individuals with severe facial scarring.

Following the passage of the ADA, the Department of Justice issued the 1991 ADA Standards for Accessible Design (ADA Accessibility Guidelines – ADAAG) to address physical access to facilities and transportation. These standards were based almost exclusively on the US Access Board's guidelines. In 1994, slight technical amendments were made. Then in 2004, after years of public comment, the US Access Board issued new guidelines that were promptly adopted by US Department of Transportation and other federal agencies. But only in 2010 did the Department of Justice issue a revised and updated ADA Standard called the 2010 ADA Standards for Accessible Design (2010 ADA Standards) that would apply to all Title II and Title III entities. These standards revised requirements for policies such as ticketing and service animals, and for physical elements such as assembly seating, established construction tolerances for certain elements and formalized long-standing guidelines for docks, fields, pools, and other recreational facilities.

While the Recreation Department did not provide IHCD with information about the dates of alterations, it is clear that the Town has undertaken renovations to facilities after the passage and enforcement of the Americans with Disabilities Act in 1991. Newly constructed or altered facilities or elements that were constructed or altered before March 15, 2012 and that do not comply with the 1991 Standards or with UFAS shall on or after March 15, 2012, be made accessible in accordance with the 2010 Standards.⁵ Further, it is important to note that those elements in existing Town facilities that are subject to supplemental requirements of the 2010 ADA Standards (i.e., elements for which there are neither technical nor scoping specifications in the 1991 Standards) such as (C) Recreational boating facilities; (D) Exercise machines and equipment; (E) Fishing piers and platforms; (H) Play areas; (J) Swimming pools, wading pools, and spas; and (L) Miscellaneous - (1) Team or player seating and (3)

⁴ To learn more qualified individuals with disabilities or to read the full text of the ADA, please visit <http://www.ada.gov/> or <http://www.disability.gov/>.

⁵ As described in 28 CFR 35.151(c) – Accessibility Standards and Compliance Date

Accessible route in court sports facilities, need to be brought into compliance with 2010 ADA Standards if there are alterations or new facilities undertaken.⁶

Though IHCD used the 2010 ADA Standards in surveying facilities, it is not expected that the facilities will meet or be brought up to all of these standards absent significant or total renovation. State and local governments must ensure that individuals with disabilities are not excluded from services, programs, and activities because facilities are inaccessible. This means Title II entities need not remove physical barriers, as long as they make their programs accessible to individuals who are unable to use an inaccessible existing facility.

Municipalities also have an Effective Communication mandate with people who have hearing, vision, or speech disabilities. And they are required to make reasonable modifications to policies, practices, and procedures where necessary to ensure program accessibility and the equal participation of people with disabilities.

Other Federal Obligations: Rehabilitation Act

While the ADA is perhaps best known of disability civil rights laws, the Town of Arlington has other ongoing Federal obligations concerning accessibility. The Rehabilitation Act of 1973 prohibits discrimination on the basis of disability in programs conducted by Federal agencies, in programs receiving Federal financial assistance, in Federal employment, and in the employment practices of Federal contractors. The standards for determining employment discrimination under the Rehabilitation Act are the same as those used in title I of the Americans with Disabilities Act.

State Obligations: Massachusetts Architectural Access Board

The Architectural Access Board (AAB) is a regulatory agency whose mandate is to develop and enforce regulations that are part of the Massachusetts Building Code designed to make public buildings accessible to, functional for and safe for use by persons with disabilities – see 521 C.M.R. In addition to writing regulations, the Board decides on variance requests, provides training on its regulations, issues advisory opinions and makes decisions on complaints. Local building inspectors are responsible for enforcing the regulations which are a specialized section of the Massachusetts Building Code – see 780 C.M.R.

The construction, reconstruction, remodeling, alteration, or change of use of a building or facility that is open to the public triggers the authority of the AAB. New construction must fully comply. For renovation, remodeling, or alteration:

- The work being done must comply with the regulations;
- If the work done in any 36-month period is greater than \$100,000, the “work being performed” is required to comply. In addition, an accessible entrance and an accessible toilet room,

⁶ As described in 28 CFR 35.150(b)(2)(i)

telephone and drinking fountain (if toilets, telephones and drinking fountains are provided) shall also be provided;

- If the work done in a 36-month period is more than 30% of the “full and fair cash value” of the building, the entire building must come into compliance.

Enforcement: Anyone can file a complaint with the Board. The Board has the authority to issue variances and/or impose fines of up to \$1000 per violation per day of noncompliance with its order.

PART B - Evaluation of Non-discriminatory Policies and Practices in Programs, Services, and Activities

Introduction

The Town of Arlington's Recreation Department operates and manages the **Reservoir Beach**, Gibbs Gym at Gibbs Center, Ed Burns Arena, North Union Spray Pool, and the Off-Leash Dog Area at Thorndike Park. In addition, the Recreation Department oversees the operations, capital improvements, scheduling and permitting to all the parks and playgrounds in the Town of Arlington under the Park and Recreation Commission's jurisdiction.¹ The Department also collaborates with the Conservation Committee and other Town Commissions to be excellent stewards of these Town assets.

Recreation program facility management and maintenance is organized into two divisions: the recreation facilities and the Ed Burns Arena at the Veterans Memorial Sports Complex.² The Town's Department of Public Works maintains the recreation facilities and the Recreation Department's rink staff (facilities supervisor and building maintenance craftsman) manages and maintains the Stateowned Arena.

The Recreation Department's programs are intended to be self-sustaining. This is being accomplished through user fees, program fees, facility rental opportunities, additional programming, fundraising and specialized marketing opportunities at the rink.³ Programs are continually being added, improved, and changed to accommodate the needs of the public. New programs offered in 2013 included: Archery, Saturday Night Lights Flag Football, Lego Classes, Toddler Art Classes, SHINE Special Needs Soccer Classes, Volleyball Clinic, Expanded Adult Tennis Lessons, Fit Doggie and Me Training, and the iCan Shine Learn to Bike program for youth with special needs.⁴ The Department is expanding its Statelicensed Kid Care after-school program and has started a new Fun School pre-school program.

In collaboration with other Town organizations, groups, and with the guidance of the Park and Recreation Commission, the Recreation Department approves, supports, and manages a vibrant schedule of Town-wide special events. For example, the Department sponsors the September Walter V. Moynihan Town Day Run in collaboration with the Boys & Girls Club and Fidelity House. In 2013, such Town-wide special events included a Daddy Daughter Dance, Egg Hunt, Halloween, and Special

¹ This summary of Department Programs and services is found in the Arlington FY15 Enterprise Fund description at http://www.arlingtonma.gov/Public_Documents/ArlingtonMA_Financial/budget/2015/EnterpriseFund.pdf, p. 160.

² The division of responsibilities reflects the fact that the skating rink is owned by the Commonwealth and managed by the Arlington Recreation Department. The facility is referred to by various names. This report uses the name provided by the Recreation Department in the Town's Annual Reports. In the Enterprise Fund report, the Recreation summary refers to the Ed Burns Arena/Sports Center Enterprise Fund. The Arlington Master Plan Working Paper Series, 2014 refers to this facility as the Arlington Sports Center and Veterans Memorial Skating Rink. ³ This list based on a review of the Department's Annual Report summaries, 2005-2013, plus the Recreation Department FY15 Budget Statement in the Enterprise Fund report, at http://www.arlingtonma.gov/Public_Documents/ArlingtonMA_Financial/budget/2015/EnterpriseFund.pdf.

⁴ 2013 Recreation Department Summary, Arlington Annual reports, p. 63.

Winter Public Skate.⁵ The Department has shared responsibilities with the School Athletic Department and District to review and manage programs and activities held at facilities with shared maintenance and scheduling tasks, such as the field permit programs and policies, and a full schedule of Summer Day programs.

Department staffing includes seasonal employees for the Recreation programs, and Seasonal Employees for the Rink and the Recreation programs held at the Ed Burns Arena/Sports Center.⁶

Regular free programs managed by the Department include the North Union Spray Park, neighborhood pocket parks and playgrounds, large parks with nature trails and picnic/seating areas, an off-leash dog park, and an off-leash dog walking program at certain parks.

Each of the programs, services, and activities that are organized, developed, implemented and managed by the Recreation Department, and subsequently provided to the public, contain background policies, practices and procedures that may impact the Department's capacity to achieve the objectives of the Title II of the Americans with Disabilities Act that are folded into the department's overall responsibilities as a representative of the Town, a public entity.

IHCD applauds the Department's proactive stance in updating its ADA Self-Evaluation at this time. This is an important administrative step to ensure that the requirements of the Title II of the ADA are being met. Additionally, a Title II entity is required to:

- a) Designate a Responsible Employee (ADA Title II - 28 CFR Part 35.107 (a)) to coordinate compliance with the ADA. The purpose of having a responsible employee – ADA Coordinator - is to ensure that when the public deals with a Town department, the public is able to identify a person who is knowledgeable with the requirements of the ADA.
- b) Adopt and distribute a public Notice (ADA Title II - 28 CFR Part 35.106) of the provisions of the ADA to members of the public who may participate in the Town's programs, services and activities. The effective notice should state the Town's obligations under the ADA and include the complete contact information of the ADA coordinator.
- c) Develop and distribute Grievance Procedures (ADA Title II - 28 CFR Part 35.107 (b)) for prompt resolution of any complaint regarding disability discrimination.

Below is a discussion of how the Department's background programs, services, resources, operations, and management practices can be utilized to further develop the capacity to meet the objectives of the Title II while adopting standard operating procedures that increase the quality of the programs, services, and activities in recreation facilities for all:

⁵ 2013 Recreation Department Summary, Arlington Annual reports, p.63

⁶ http://www.arlingtonma.gov/Public_Documents/ArlingtonMA_Financial/budget/2015/EnterpriseFund.pdf, p. 163.

1) Recommendations to increase the Department's capacity to provide the necessary information to the public, as required by the administrative mandates of the Title II:

- The Town of Arlington provides contact information of the directors of each program at its Recreation Department but there is not information about the ADA Coordinator⁷. Ensure that staff knows who to contact in case of a request from residents and/or visitors for accommodation and/or modifications.
- Adopt a uniform policy regarding the posting of ADA notices in the Towns parks. Provide the information on an ongoing basis whenever necessary. This information should be included in job applications, local newspaper, Town's website, and posted at all facilities where services, programs and activities are provided.
- Ensure that the information on the parks and recreation page of the Town website has a nondiscrimination notice about the Town policies.
- Ensure that information about ADA compliance and availability of accommodations to the public and first-time visitors as well as complete contact information of the ADA Coordinator (name, office location, email address, telephone, fax, etc.) is provided in all publications, admissions materials, events notices, and program announcements distributed by the Department.
- At all public entrances of indoor facilities (Recreation Department Office, Ed Burns Arena, Gibbs Gym) as well as at bulletin boards provided at outdoor facilities, post a Notice of the ADA Compliance including complete contact information of the ADA Coordinator, in addition to the information about the Director of the Recreation Department.
- Provide a copy of the grievance procedure form in all materials distributed by the Recreation Department. The form should include the complete contact information of the ADA Coordinator, in addition to the information about the Director of the Recreation Department.

2) Recommendations to increase the Department's site management and planning capacity relative to the operation and management of facilities managed by the Department (Reservoir Beach, Gibbs Gym at Gibbs Center, Ed Burns Arena, North Union Spray Pool, and the Off-Leash

⁷ Title II of the ADA makes clear that a public entity must designate a responsible employee and adopt grievance processes. See 35 CFR Part 35.107 (a). While the Town of Arlington has designated an ADA Coordinator- Jack Jones, who is the Director of Housing and Disability Programs- the Town's online directory of "Assistance Programs" (<http://www.arlingtonma.gov/departments/health-humanservices/assistance-programs>) lists the Arlington ADA office phone number and email contact under the heading "*Disabled Persons Protection Commission.*" This listing does not provide adequate information for interested residents to learn who the Town's ADA Coordinator is; or, what the Town ADA Coordinator's role and responsibilities are; or, how this person can and will assist residents.

Dog Area at Thorndike Park) are developed against the backdrop of the civil rights principles and prohibitions of the ADA:

No qualified individual with a disability shall, on the basis of disability, be excluded from participation in or be denied the benefits of the services, programs, or activities of a public entity, or be subjected to discrimination by any public entity.⁸

- As facilities are altered, the Department should incorporate the structural accessibility findings from this ADA Self-Evaluation report into the articulation of existing site conditions at each program facility – please refer to Part C - Evaluation of Facilities. For example, the **Reservoir Beach site management plan⁹** can incorporate the following additional information:
 - **The beach access ramp leading into the water is not maintained as an accessible route with smooth, firm and non-slip floor surface conditions;**
 - **The concrete walkway to the toilet rooms and concessions building has excessive cross slopes;**
 - **The concession counter is inaccessible because it is too high;**
 - **Play areas are not adjoining an accessible route, are surfaced with sand, which is an inaccessible ground surface material, and one play area is separated from surrounding benches and tables by a recessed border;**
 - **Benches and picnic tables are not adjoining an accessible route and lack a clear floor location for integration of users of wheeled mobility devices;**
 - **Accessible parking spaces furnished during the summer season are not connected to the beach area by an accessible route.**
- Site accessibility maintenance and repair issues should be integrated into the "outstanding issues" priorities list and considered in the same manner as other general population access issues. For example, the **Reservoir beach site management plan** mentions the lack of *year round access* and the impact of limited seasonal parking availability as a concern to be addressed in tandem with the landscape remediation plans. Where general public access to facility programs is being expanded, consider flagging any remaining physical and program accessibility needs at the facility into those planning efforts right from the start.
- The Department is constantly juggling different construction projects with different construction companies. Nevertheless, the Department should update or establish a set of Department-wide standards to ensure that construction teams provide accessible pedestrian facilities along construction sites. For example, during the renovation of the seasonal spray pool at Lussiano Field, the existing accessible route to the playground and basketball court was obstructed by the construction zone restricted to the construction staff. Because no alternate pedestrian route was provided to the areas open to the public during the renovation, residents with disabilities do not have an accessible entrance to the facility.

⁸ 28 CFR Part 35. § 35.130 General prohibitions against discrimination.

⁹ The Reservoir Site Management Plan was reviewed within a document dated 9/27/07 and may not be the most updated version: Town of Arlington Open Space and Recreation Plan Update 2007 - 2012 (9/27/07), Appendix J.

- As part of this ADA Self-Evaluation report, several facilities were inspected during inclement weather, including during and immediately after snowstorms in the winter of 2013/2014. The Department must ensure maintenance of accessible features during inclement weather and should create a comprehensive maintenance program and schedule to check and maintain all accessible parking spaces, accessible routes between public transit / sidewalks / parking, points of entry to the facilities, tables, benches and areas adjacent to them, areas adjacent to bulletin boards and other directional or informational signs.
- Management guidelines for each facility should be standardized and scheduled with accessibility issues included as part of the program. For example, at the **Reservoir Beach**, the basic ground maintenance program can include:
 - **Sweeping the beach access ramp leading into the water free of sand;**
 - **Landscaping around bench and picnic tables to maintain accessible firm, level and slip-free paths to approach and use such elements;**
 - **Checking play area ground material cross slopes and raking, replenishing and sifting loose ground surface materials as needed to maintain firm, smooth, and level accessible cross slopes and a surface free of hidden sharp objects at and around play elements.**

Proposed Capital improvement objectives regarding structural accessibility improvements are measurable and can be clearly stated within updates to site management plans as facility management achievements, when complete. An example of measurable objectives might be:

"An accessible route with consistent smooth and firm 60-inch width, cross slope of no more than 2.08% and run slope of no more than 5% will be constructed leading between the parking lot and the beach access route before the start of the FY15 season."

Upon completion of this project, the Recreation Department might be able to accurately report:

"An accessible route was installed between the parking lot and the beach access route prior to the start of the FY15 season. Concurrently, there was an N% increase in the purchase of senior beach tags during the FY15 season."

- 3) During monthly meetings, the Recreation Department and Park and Recreation Commission develop new policies impacting the use of, and generally expanding the availability of, programs that reach an ever-wider group of residents. **Recommendations to increase the Department's inclusive development of policies, practices, and procedures:**

- Ensure that all community meetings and outreach takes place at facilities known to be fully accessible.⁸ Going forward, the Department is already on track in proactively considering site accessibility;
 - Develop an "awareness" checklist of language and issues that may tend to exclude or provide unreliable information to individuals with physical, sensory, cognitive, and environmental disabilities; this checklist will assist the Department in avoiding unintentional language that may tend to exclude individuals with disabilities. Seek input from constituents as appropriate;⁹
 - Where new policies or practices implement physical changes to facilities and programs, ensure that the standards or guidelines for such programs build in accessibility standards from the start, rather than viewing accessibility as an "additional" expense.¹⁰ For example, the portable toilet pilot program began in 2009; and may continue to expand to more facilities. In this program, the Department should ensure that the first portable toilet that is installed at any field is an accessible portable toilet, since "at least one accessible" is the general standard;
 - Where the Department, in concert with the Commission, develops guidelines for built-in elements and physical changes or additions to the physical site, consider instituting a default procedure to check current accessibility standards prior to publishing program guidelines. This will enable the department to provide reliable information about program accessibility issues going forward. Accessibility standards, per the ADA, are specific (even construction tolerances are expressed as within a range of specific measurements); therefore, accomplishment of the standards is a measurable achievement.
- 4) The Department's programs are intended to become self-sustaining. New programs are constantly being developed and added to the Department's portfolio. **Recommendations and considerations for future program development** are developed against the backdrop of the civil rights principles and prohibitions of the ADA, in addition to the supportive architectural accessibility standards, known as the 2010 ADA Standards:

A public entity shall administer services, programs, and activities in the most integrated setting appropriate to the needs of qualified individuals with disabilities.¹¹

Except as otherwise provided in § 35.150, no qualified individual with a disability shall, because a public entity's facilities are inaccessible to or unusable by individuals with disabilities, be

⁸ For example, the Green Dog Neighborhood Outreach meetings (Oct. 2007- January 2008) took place at the Selectmen's Meeting Room in Arlington Town Hall, which is currently documented as a partially accessible facility.

⁹ For more information regarding communicating with and about people with disabilities, please refer to <http://www.dol.gov/odep/pubs/fact/comucate.htm> and <http://www.unitedspinal.org/disability-etiquette>.

¹⁰ Disability Commission Minutes, July 21, 2010 show that CDBG funding was used to pay for the "additional cost of the accessible portable toilets."

http://www.arlingtonma.gov/Public_Documents/ArlingtonMA_DisabilityMin/2010/07-21-2010?textPage=1

¹¹ § 35.130

(d)

*excluded from participation in, or be denied the benefits of the services, programs, or activities of a public entity, or be subjected to discrimination by any public entity.*¹²

*(a) General. A public entity shall operate each service, program, or activity so that the service, program, or activity, when viewed in its entirety, is readily accessible to and usable by individuals with disabilities.*¹³

- Using the information from this ADA Self-Evaluation report, and going forward, the Department should consider only siting new and expanded programs in facilities that have been accurately evaluated to be accessible;
- Where accessible elements are not within the general path of travel (such as where older existing facilities include an accessible entrance that is not being used as the primary entrance) this information should be published as part of the program facility descriptions, and provided in all facility descriptions as standard operating practice;
- Effective communications issues should be identified as part of program planning and development, and also as part of any marketing opportunities being developed. This includes having alternate formats of visual information readily available, such as having Large Print and accessible digital files already prepared and ready to provide upon request. Similarly, the Department should ensure that registration procedures that involve phone communications include trained staff available for real-time relay phone conversations; or, with the use of more current and effective communication methods for individuals with disabilities, such as videophones, captioned telephones, voice carryover and hearing carryover phones, and pagers and other computer devices that send text or IM messages as options for communication. In addition, all associated web-based forms and public information should be accessible to individuals using assistive technology prior to publication and launch of program. In coordination with Town's ADA coordinator, the Department should maintain a list of such resources and maintain and update this accessible communications list as a standard operating practice.
- Ensuring that publicly disseminated information regarding the Department's programs and facilities is effectively providing accurate and necessary information, an accurate description of the accessibility conditions at Department facilities should be included in public information as a standard operating procedure.
- Program and facility information should also be reviewed and updated routinely to prevent confusion and omission of details that impact program access and wayfinding. (As an example: the Grove St./ Wellington Park Tennis program activities includes a link to Recreation facility

¹² § 35.149 Discrimination prohibited.

¹³ § 35.150
(a)

descriptions; but neither Grove St. nor Wellington Park are included within that link to Facility listings.¹⁴

- Where school bus transportation, or any transportation, is provided as part of the program (such as in the Club Rec program), the Department should make arrangements for alternate accessible transportation options upon request. These accessible options should be provided as part of that programs description to the public as a standard operating procedure.
- While the Department is not prohibited from *broaden[ing] program offerings for children with special needs*¹⁵, it is important for the Department to clarify the principles that cause separate "special needs" programming to be advanced; and to balance those principles with the general information published in the seasonal brochure, which states *"Participants with special needs are encouraged to attend all of our programs. Staff members are sensitive to their needs and will do everything possible to assist. If you are unsure about program registration, call regarding specifics."* Above all, the primary principle should establish why such types of programs are most appropriate for the population the Department expects to serve.
- As the Department continues to clarify what types of programs are particularly suitable and appropriate to add to and develop within its portfolio, the following Title II principle should inform these clarifications and considerations:

*A public entity may not deny a qualified individual with a disability the opportunity to participate in services, programs, or activities that are not separate or different, despite the existence of permissibly separate or different programs or activities;*¹⁶

- The Department should ensure that published program information does not tend to *impose or apply eligibility criteria that screen out or tend to screen out an individual with a disability or any class of individuals with disabilities from fully and equally enjoying any service, program, or activity, unless such criteria can be shown to be necessary for the provision of the service, program, or activity being offered;*¹⁷

For example, the Fantastic Gymnastics class at Gibbs Gym has a simple age eligibility requirement: children between 18 months and three years of age must attend with a parent. Added to that is a note that *"children should be good walkers."*¹⁸ This type of eligibility criteria will tend to screen out

¹⁴ <http://www.arlingtonrec.com/info/facilities/>

¹⁵ This is a stated FY2015 Department Objective in the FY2015 Recreation Enterprise Fund publication, p. 160.

¹⁶ § 35.130 (b) (2)

¹⁷ § 35.130 (b) (8)

¹⁸ Arlington Recreation Program Brochure, Spring/Summer 2014, p. 6.

families with children who may never be "good walkers." Since participation in this basic gymnastics is not conditioned upon any type of audition, it does not appear that such criteria is necessary for fulfilling the program's objectives and should be eliminated from the description.

As another example, the off-leash dog brochure includes the following rule: "You must be able to see your dog at all times and maintain effective verbal control of your dog." This language may give the unintended impression that visually impaired persons were not expected to participate in the program. A suggested alternate phrase is "you must be in contact with your dog at all times."

Further, the Department should be on the lookout for these kinds of subtle criteria, which can tend to exclude families and children who would otherwise wish to explore such opportunities and to benefit from participation just like the other participants.

- 5) In collaboration with other Town organizations, groups, and recreation centers; and with the guidance of the Park and Recreation Commission, the Department approves supports and manages a vibrant schedule of Town-wide special events. **Recommendations regarding the Department's collaborative services** are provided against the backdrop of the civil rights principles and prohibitions of the ADA, in addition to the supportive architectural accessibility standards, known as the 2010 ADA Standards:

A public entity may not, in determining the site or location of a facility, make selections – (i) That have the effect of excluding individuals with disabilities from, denying them the benefits of, or otherwise subjecting them to discrimination; or (ii) That have the purpose or effect of defeating or substantially impairing the accomplishment of the objectives of the service, program, or activity with respect to individuals with disabilities.

Recommendations regarding collaborations with volunteer groups, sports and team organizations, etc.:

- Using the information from this ADA Self-Evaluation report, and going forward, the Department should condition approval of special event locations to only occur at sites or areas that are reliably known to be accessible by current standards;¹⁹
- Where the proposal is for special and new installations, the department should include the following basic checklist:
 - The installation adjoins an accessible route, which is within the general public path of travel;
 - Integrated seating for users of wheeled mobility devices is built into any installments where seating is provided;

¹⁹ For detailed information about accessible temporary events, please refer to <http://dhs.sd.gov/accessibility/documents/Accessible%20Temporary%20Events%20Planning%20Guide.pdf>

- If the installation includes public contact, all controls must be within reach ranges (generally 15" - 48" above the ground or floor) by a forward or parallel approach; ○ If there are design considerations, these must include accessibility standards where appropriate and universal design principles wherever possible.

An example of a program installation that is a wonderful addition to an already unique facility is the art installation at the Menotomy Rocks Park. However, this novel social program is not currently adjoining an accessible route; and, there is no location around this "Council Ring" for integrated seating of individuals using wheeled mobility devices, canes, walkers, etc. Therefore, at this time, the program is not only inaccessible, but newly so. Relatively minor accessibility adjustments are needed to transform the art installation into an inclusive asset as soon as is practicably possible – please refer to Part C - Evaluation of Facilities for recommendations.

Going forward, the Department can be proactive in enabling inclusive considerations to be part of program and element installation at all facilities under its management; and, in the case of installations that were not developed with these considerations, the Department is responsible for ensuring that program accessibility standards are met as soon as is practicably possible.

6) The Department has shared responsibilities with the School Athletic Department and District.²⁰ The Department is advised to share the recent (2013) Department of Education Guidance provided to ensure that students with disabilities consistently have opportunities to participate in extracurricular athletics equal to those of other students.²³ **These minimal structural accessibility recommendations for the fields- and courts-based programs** are necessary for program accessibility under Title II, regardless of whether the users are agents of the Town and School district, or whether they are sports organizations, non-resident teams, and individuals. Without implementation of these minimal structural improvements, the active sports programs at these shared facilities are not fulfilling minimal Title II program requirements:

- Wherever there are team benches, dugouts and clubhouses, these must adjoin an accessible route and include at least one clear ground space for integrated wheelchair seating. This should be provided at both home and away team dugouts;
- Wherever there are bleachers, spectator seating, or lawn benches anchored into the environment, these must be adjoining an accessible route and provide integrated wheeled mobility seating spaces;
- Wherever there are courts not adjoining an accessible route, install an accessible pathway leading to both sides of the court. If topological constraints make that infeasible, then provide the maximum accessible route that is feasible; and at least an accessible route to one side of the court.

²⁰ Note: School Department programs were not included within this 2013-2014 ADA Self Evaluation. ²³ online at: <http://www2.ed.gov/about/offices/list/ocr/letters/colleague-201301-504.pdf>

For a complete list of fields and courts requiring these modest improvements, please refer to the Structural Accessibility section under Part A - Executive Summary. An index of findings by type of program, age-level and grade-level is included later in this Part B - Evaluation of Non-discriminatory Policies and practices in Programs, Services, and Activities. There are a number of school-based programs listed within the Department's portfolio that are held at locations that were not within the scope of this ADA Self-Evaluation report. A listing of facilities not within the scope of this evaluation is found at the end of Part A - Executive Summary.

- 7) The Department and Commission also occasionally review or approve streetscape projects, as requested, where they will impact Recreational facilities. **Recommendations about review of crosswalks, curb ramps, and sidewalks are based on the Town and Department's obligations to ensure that, wherever such alterations are made, they are compliant with the current accessibility standards**, which have been codified for the primary purpose of facilitating at least minimal program accessibility in cases where there are structural (physical) barriers. In the case of streetscape projects, the program accessibility mandate under Title II of the ADA ensures that individuals can approach and enter a municipal program via an accessible route provided to all accessible "site arrival points." Here's that regulation:

Site Arrival Points. At least one accessible route shall be provided within the site from accessible parking spaces and accessible passenger loading zones; public streets and sidewalks; and public transportation stops to the accessible building or facility entrance they serve.²¹

This short paragraph includes some of the most essential program accessibility needs for the majority of facilities managed by the Department, with the guidance of the Commission, as it continues to develop and to maintain inclusive high-quality parks and recreation programs.

The necessity for the Department's programs and facilities to be approached and entered by accessible pedestrian routes connected to multiple modes of transportation – including the Minuteman Commuter Bikeway, the many public transit stops within walking distance (within 300 feet) of these facilities, along and between Massachusetts Avenue, Broadway, Park Avenue, and Summer Street; and, from nearby pedestrian public rights of ways along neighborhood streets and sidewalks – is especially highlighted for individuals with disabilities and older residents, who share a disproportionate lack of access to more private motorized modes of travel.

Program accessibility considerations regarding public rights-of-ways (crosswalks, curb ramps, sidewalks) exist alongside the basic architectural accessibility standards, which support program accessibility requirements with a code of minimal architectural standards. The facility surveys encountered approximately 18 facilities within the scope of this ADA Self-Evaluation report which had received relatively recent (within the past decade) streetscape improvements; yet, were not compliant with the architectural accessibility standards in effect at the time of construction.²⁵

²¹ Department of Justice 2010 ADA Standards: Titles II and III. Scoping requirements: Accessible Routes for Site Arrival Points. ²⁵ This discussion is included in Structural Accessibility under Part A - Executive Summary.

In order for the Department and also the Town to ensure effective stewardship of municipal assets, there needs to be coordinated management and oversight of such streets and roadway construction – from the preliminary phase of scoping the limits of the project, to the post-construction phase of surveying the completed construction and mitigating any issues found prior to the completion of the contract.

At this time, the Department is advised to oversee the planning of street and roadway projects adjacent to facilities with the following recommendations:

- When streetscape alterations are reviewed before the Department and Commission, ensure that the scope of the work includes at least one accessible route, upon completion, from the nearest public transit stop to the accessible entrance of site;
- When working with the Town and DPW to prepare contracts for services by architects, engineers, and contractors involved in building and altering highways, streets, roads, sidewalks, other walkways, transportation stops, and curb ramps, consider including a provision specifically requiring compliance with Title II of the ADA, including compliance with the ADA 2010 Standards;
- Where completed work has resulted in non-complying elements – as those included within Part C - Evaluation of Facilities – the Department should include such corrective work not fully within the Department's jurisdiction as part of a series of Town budget requests over the next five to ten years;
- Where completed work has resulted in gaps of connection between site arrival points and the nearest public transit stop, off-street parking facilities, streets and sidewalks, any passenger drop-off and pick-up zones, and/or access links to the Minuteman Commuter Bikeway and associated shared-use trails, the Department and Commission should develop facility-based capital improvement projects to mitigate those gaps;
- Streetscape projects should intersect with the necessary structural accessibility improvements at such facilities wherever feasible, so that interruptions in program service at those sites are as minimal as possible; and so that, when sites are re-opened following improvements, accessible streetscape infrastructure is provided right when the sites open again.

An additional recommendation relevant to site arrival points is provided based on the fact that, in at least one (school-related) off-street parking facility, the access aisles were being used as parking spots rather than as components of the accessible parking spaces, despite clear cross-hatch markings at the access aisles and signage in front of the spaces. This can have the effect of a program barrier, because access aisles are a structural accommodation that allows individuals using wheeled mobility devices to accommodate transfers between vehicle and pedestrian travel:

- Provide public information on website and in public brochures informing the general public about the need for access aisles to remain clear of vehicles. The Cambridge Commission inspires this recommendation for Persons with Disabilities' video Public Service Announcement, called ***Not even for a minute***.²²

IHCD would like to note that the Department and Commission have already shown awareness and proactive stewardship in its Capital Project management; the recommendations mentioned above are supportive of the Department's demonstrated capacities to manage capital improvements projects to successful conclusions.

Where non-complying structural issues are found, they are detailed as part of each facility's structural accessibility recommendations provided in Part C - Evaluation of Facilities. As the Department continues to identify solutions to program accessibility barriers, these non-complying architectural elements must be corrected to comply with the 2010 ADA Standards.²³

Programmatic accessibility problems are often solved most efficaciously through the design and renovation projects. The Department may also consider alternate methods to accomplish its Title II objectives, as long as integration is a primary consideration.

Indexed Analysis of Programs

Program Accessibility Findings were analyzed, as a whole, by type of program (active, passive, summer), and by age and grade eligibility. These findings are based on the information produced within the Recreation Department's web-based resources, at the Town of Arlington's Website²⁴ and at the Recreation Department's information and registration website²⁵. There are a number of program findings that are inconclusive, because similar programs are offered at facilities that were not included within the scope of this ADA Self-Evaluation report.

In the Program Analysis Index below, policies, information and communication practices and procedures are noted where there are questions and concerns about whether the information provided is sufficient to enable individuals with disabilities to confidently pursue the registration process.

²² Link to this short video, ***Not even for a minute*** is at:

<https://www.cambridgema.gov/DHSP/programsforadults/ccpd.aspx>

²³ *Non-complying new construction and alterations constructed or altered after the effective date of the applicable ADA requirements and before March 15, 2012, shall, on or after March 15, 2012 be made accessible in accordance with the 2010 ADA Standards.* See Guidance on the 2010 ADA Standards for Accessible Design, published September 15, 2010, § 35.151(b)(4)(ii)(C) Path of travel--safe harbor; § 35.151(c) Accessibility standards for new construction and alterations; and § 36.403 Alterations: Path of Travel. Also see: § 36.406 Standards for New Construction and Alterations.

²⁴ http://www.arlingtonma.gov/Public_Documents/ArlingtonMA_Recreation/index

²⁵

<http://www.arlingtonrec.com/info/>

The following programs, services and activities were analyzed, as a whole, within the Department's portfolio, and findings were indexed according to type of program, free or fee-based, and further indexed according to age and grade eligibility, as described in the Department's public information:

Active Sports:

- Badminton;
- Baseball;
- Basketball;
- Biking;
- **Boating;**
- Fencing;
- **Fishing;**
- Fitness;
- Karate, Little Dragons, Ninjas;
- Indoor Skating;
- Soccer;
- **Swimming;**
- Tennis;
- **Volleyball.**

Passive/Social Recreation:

- Arts;
- **Community Gardens;**
- **Off-Leash Dog Program;**
- **Paved Walking Trails;**
- **Picnic Areas;**
- **Scenic Resources and Unique Environments³⁰;**
- **Water Based Trails, Natural Surface;**
- **Wildlife Corridors.**

Active Sports

Swimming Fee-based:

- Chlorinated and filtered outdoor natural swim area at **Reservoir Beach**: Swimming Lessons for Parent/Child (ages 2 -3), Water Adjustment (ages 4 – 5), and Level Swimming American Red Cross (ages 6 - 8) between June and August.

Finding: When viewed as a whole, this program is currently not programmatically accessible due to architectural barriers at Reservoir Beach.

Passive/Social Recreation

Community Gardens

Fee-based:

- Magnolia Field;
- Robbins Farm.

Finding: When viewed as a whole, this program is currently not programmatically accessible due to architectural barriers at the facilities mentioned above. The Department's applications as well as information about rules and regulations²⁶ need to specify that, at this time, these programs are currently not accessible to individuals living with mobility disabilities.

Free:

- **Hurd / Reservoir Trail: Wildlife Habitat Gardens**,²⁷
- Spy Pond and Hurd Field: Rain Gardens.²⁸

Finding: This program was intended to be accessible; however, at this time, both Wildlife Habitat and Rain Gardens are currently not programmatically accessible due to architectural barriers at the facilities mentioned above.

Off-Leash Dog Program²⁹ Free:

- Buzzell Field;
- Cutter School / Reinhart Park;
- Hill's Hill;
- Hurd / Reservoir Fields;
- Menotomy Rocks Park;
- McClennen Park;
- Poet's Corner;
- **Reservoir Beach**;
- Robbins Farm;
- Spy Pond Field;
- Spy Pond Park;
- Summer Street Park;
- Thorndike OLRA;
- Wellington Park.

Finding: When viewed as a whole, this program is currently not programmatically accessible due to architectural and policy-based barriers at the facilities mentioned above.

²⁶ http://www.arlingtonma.gov/public_documents/arlingtonma_recreation/communitygardens/gardenrulesregs.pdf

²⁷ Arlington Reservoir Committee, "Wildlife Habitat Garden,"
http://www.arlington2020.org/reservoir/Habitat_Garden.htm

²⁸ Arlington Master Plan Working Paper Series: Natural Resources and Open Space, 7-8.
http://www.arlingtonma.gov/Public_Documents/ArlingtonMA_Planning/masterplan/workingpapers/NaturalResWkgPaper0516.pdf

²⁹ Green Dog proposed locations, 2007
http://www.arlingtonma.gov/Public_Documents/ArlingtonMA_WebDocs/greendogpilot2007.pdf
f

Paved Walking Trails (added since 2004)

Free:

- **Hurd/Reservoir Trail;**
- McClennen Park;
- Menotomy Rocks Park;
- Robbins Farm;
- Spy Pond Field: SE field paved walking path;
- Spy Pond Park: shoreline trail between North and South beaches;
- Thorndike Park;
- Waldo Park.

Finding: When viewed as a whole, this program is currently not programmatically accessible, mainly due to lack of connection between walking trails and other facility program areas, elements, and amenities at the facilities mentioned above.

Picnic Areas Free:

- Most facilities.

Finding: When viewed as a whole, this program is currently not programmatically accessible due to architectural barriers at most facilities.

Fee-based:

- Most facilities:

Finding: A 'Picnic Area Request' form must be filled out for birthday parties and small gatherings under 100 people. The Department's application form needs to specify that, at this time, this program is currently not accessible to individuals living with mobility disabilities.

Scenic Resources and Unique Environments³⁸ Free:

- Buzzell Field: link to Bikeway scenic assets;
- Hill's Hill: link to Bikeway scenic assets;
- Hurd / Reservoir Fields: Mill Brook, **Reservoir**, Wetlands, link to Bikeway;
- Menotomy Rocks Park: glacial rock formations and woodlands;
- **Reservoir Trail: Mill Brook, Reservoir, Wetlands;**
- Robbins Farm: Boston Skyline Viewing Oval;
- Spy Pond Park: Walking paths, Wetlands, link to Bikeway;
- Summer Street Park: link to Bikeway scenic assets.

Finding: Although the programs offered in the facilities mentioned above do not currently need to comply with enforceable requirements for accessible outdoor areas, awareness of standards for accessible outdoor trails is in evidence in the additional trails added within the past decade at the Menotomy Rocks Park, Reservoir Trail, and Spy Pond Park.

Water Based Trails, Natural Surface Free:

- McClennen Park;
- Menotomy Rocks Park;
- **Reservoir: shoreline trail;**
- Spy Pond Park: North;
- Spy Pond Park: South.

Finding: When viewed as a whole, this program is currently not programmatically accessible due to architectural barriers at the facilities mentioned above.

³⁸

from Town of Arlington Open Space and Recreation Plan Update 2007 - 2012, pp. 66 - 68

http://www.town.arlington.ma.us/Public_Documents/ArlingtonMA_BComm/openspace/OSPlans/2007_2014/OSR_P_2007_3.pdf

Wetlands info from Arlington Master Plan Working Paper Series: Natural Resources and Open Space, 7-7:

http://www.arlingtonma.gov/Public_Documents/ArlingtonMA_Planning/masterplan/workingpapers/NaturalResWkgPaper0516.pdf

Wildlife Corridors³⁰

Free:

- Linkages to Minuteman Bikeway;
- Spy Pond Park;
- McClennen Park;
- **Reservoir.**

Finding: Although the Town's wildlife programs do not currently need to comply with enforceable requirements for accessible outdoor areas, awareness of standards for accessible outdoor areas is in evidence and increasing.

Summer Programs

Fee-Based:

- Dallin Elementary School: Club Rec Full Day, Kids Corner (ages 3 - 5);
- Ottoson Middle School: Super Sports;
- Spy Pond Field: Spy Ponder Baseball Clinic (ages 8 - 10);
- Summer Street Park (multi-purpose field): Thundercat Sports (ages 2 - 12);
- Multiple Locations (including high adventure course at Wellington Park, **swimming pool at Reservoir Beach**): Summer Exploration Club (ages 10 - 14).

Finding: When viewed in part, the programs offered at Spy Pond Field, Summer Street Park, and Reservoir Beach are currently not programmatically accessible due to architectural barriers at these facilities. Additionally, information regarding school bus transportation for Club Rec (to and from the

³⁰ from Town of Arlington Open Space and Recreation Plan Update 2007 - 2012, p. 64

http://www.town.arlington.ma.us/Public_Documents/ArlingtonMA_BComm/openspace/OSPlans/2007_2014/OSR_P_2007_3.pdf

Reservoir Beach) in Winter and Spring/Summer 2014 brochures did not include information about accessible transportation options.

There is not enough information to complete the review of these programs because Dallin Elementary School and Ottoson Middle School were not included by the Recreation Department in the list of facilities to be assessed.

Age-Based Programs

Ages 18 - 99

- **Reservoir Beach: Beach tags;**
- Gibbs Gym: Fencing, Zumba for Adults;
- Thorndike Park (dog park): Fit Doggie and Me;
- Wellington Park (tennis courts): Summer Adult Tennis Programs.

Finding: The following programs are not programmatically accessible due to architectural barriers at the facilities mentioned above.

Resource List

- 1) January 25, 2013: (Press Release) ("Dear Colleague" Letter) (January 25, 2013) from Acting Assistant Secretary for Civil Rights Seth Galanter, addressing equal access to extracurricular athletics for students with disabilities. The Dear Colleague letter provides an overview of the obligations of public elementary and secondary schools under Section 504 of the Rehabilitation Act (Section 504), and the Department's Section 504 regulations; cautions against making decisions based on presumptions and stereotypes; details the specific Section 504 regulations that require students with disabilities to have an equal opportunity for participation in nonacademic and extracurricular services and activities; and discusses the provision of separate or different athletic opportunities.
- 2) See: <http://www2.ed.gov/about/offices/list/ocr/letters/colleague-201301-504.pdf>
- 3) American Foundation for the Blind, Recreation and Leisure for People Who Are Blind or Visually Impaired: <http://www.visionaware.org/info/everyday-living/recreation-and-leisure/12>
- 4) CDC Report: Aerobic Inactivity Linked to Increased Incidence of Chronic Disease in Adults with Disabilities, May 2014: <http://www.cdc.gov/media/releases/2014/p0506-disability-activity.html>
- 5) Benefits and Barriers To Fitness For Children With Disabilities:
<http://www.nchpad.org/173/1308/Benefits~and~Barriers~To~Fitness~For~Children~With~Disabilities>

PART C – Evaluation of Facilities

Introduction

This ADA Self-Evaluation report includes a summary of architectural barriers and proposed barrier removal solutions for 33 Town-owned and Department-operated facilities:³¹

- Recreation Department Office
- Bishop Field
- Buck Field
- Buzzell Field
- Crosby School / Tennis Courts
- Cutter School Park
- Ed Burns Arena
- Florence Avenue Park
- Gibbs Gym
- Hill's Hill
- **Hurd / Reservoir**
- Locke School Playground
- Lussiano Field
- Magnolia Field
- McClennen Park
- Menotomy Rocks Park
- Ottoson Field / Crusher Lot
- Parallel Park
- Parmenter
- Peirce School Park
- Pheasant Avenue / Greeley Playground
- Poet's Corner
- **Reservoir Beach**
- Robbins Farm
- Scannell Field
- Sports Complex- Site Arrival Points³²
- Spy Pond Field & Tennis Courts
- Spy Pond Park
- Summer Street Park
- Thorndike Park
- W.A. Peirce Fields
- Waldo Park
- Wellington Park

³¹ The Town of Arlington has provided IHCD with the list of facilities to be assessed. IHCD is not contractually responsible for any additional facilities that are not included in the list above.



Hurd Field / Reservoir Trail

Hurd Field and the Reservoir Trail are beautiful natural assets and a multi-use unique facility. Thoughtful re-grading of the Trail provides an accessible route around some of the Reservoir, and the accessible trail continues past the Wildlife Habitat Gardens, which was intended to be accessible.³³

Readily achievable barrier removal issues include the provision of accessible connecting pathways at and through Hurd Field to connect the accessible parking lot to the perimeters of field playing areas, team seating, bleachers, and other amenities.

The major facility interior need is to provide an accessible connection between the back of Hurd Field and the Spillway/Trail area. This will connect the Reservoir trail to the Fields; and provide improved viewing access to the lovely Wildlife Habitat Garden signage and plantings.

Location: Drake Road, Arlington Reservoir

Year Built:

Reservoir built in 1890's

Known Renovations since 1991:

1988 renovations: bridge renovation to Hurd Field, expanded parking, granite benches every 1/4 mile, map³⁴.

1997: unspecified accessibility improvements.²⁰

2004: Dam Restoration Project included new smooth-deck bridge, new graded pathway covered in pea stone.

2011: Installation of Wildlife Habitat Garden

2012: Hurd Field/Drake parking lot- Parking lot resurfaced and restriped as part of EPA Porous Pavement Project.³⁵³⁶

Primary Function Areas Surveyed:

- 2 Parking lots
- 2 Softball/little league fields
- Large field suitable for soccer and lacrosse
- Team dugout areas
- Bleacher area
- Reservoir Trail
- Wildlife Habitat Meadow & Shade Gardens
- Spillway and smooth-top bridge
- Viewing settings

Public Programs: Open 5 a.m. to 9 p.m.

- Sports fields with nighttime lighting
- Environmental monitoring of EPA Porous Pavement Project
- Passive recreation

³³ see 2006 minutes of Reservoir Committee
http://www.arlington2020.org/reservoir/Habitat_Garden.htm

³⁴ info retrieved from
<http://www.arlington2020.org/reservoir/ResHistory.html> ²⁰ info retrieved from

<http://www.arlington2020.org/reservoir/ResHistory.html>

³⁵ See

<http://yosemite.epa.gov/opa/admpress.nsf/0/DE2F00FC5FC55E85257ABD004FA332>

Issues

Approach & Entrance

Pedestrian Crosswalk Area

A two-way crosswalk area located at the intersection of Lowell St. and Westmoreland requires maintenance.

Curb Ramps

Curb ramp at signed crosswalk leads to inaccessible pedestrian entry point at parking lot fence opening. of facility. (Photo 1)



Photo 1

Sidewalk along Westmoreland perimeter fence needs maintenance. The pedestrian zone is not blended to level and smooth at parking lot

Apex curb ramps at Lowell St. crosswalk are not wholly contained within crosswalk and lack detectable warnings.

Curb ramp at crosswalk leading to Beach parking lot fence opening leads to highly inaccessible entry walkway. (Photo 2)



Photo 2

Sidewalks

At least one accessible route is needed from public streets/sidewalks to entry points of facility entry point. Sidewalk has excessive cross slopes. (Photo 3)

All of the above issues negatively impact pedestrian access from nearby public transit stops. Crosswalks at Massachusetts Ave. @ Paul Revere Road (routes 62, 62/76, near Drake Rd.); are also not supported with accessible pedestrian infrastructure.

Photo 3



Parking

Two parking facilities are provided at two locations within this multi-use facility.

The seasonal public parking lot on Lowell Street is not striped, does not include accessible parking spaces or an accessible pedestrian surface. Water pooling and cross slope issues were found. (Photo 4)

The Drake Road Parking lot is well maintained, and has approximately 62 spaces, with at least 4 accessible spaces.



Photo 4



Photo 5

Point of Entry

The pedestrian entry point at the Lowell/Westmoreland parking facility does not include a level, smooth path to the Reservoir Trail entry. This entry point is marked by off limit boulders, which are not spaced in a manner that provides adequate accessible width, slope and ground surface materials for rolling pedestrian approach and entrance.

(Photo 6)



Neither of these entry points provide a continuous, level-graded, smooth, firm and slipfree route connected to park facilities.

The two pedestrian entry points at the Hurd Field entrance are from the Drake parking lot and from the back of the field, near the spillway bridge.



Access to Facility Areas

Interior Walkways

A stone gravel and dust walking trail was added as part of the 2006 Dam restoration project. While well graded, this path does not yet provide a continuously smooth, level approach and use route to all the facility areas at this multi-use facility.

Secondary trails branching off the trail to Wildlife Garden and in the direction of Hurd Field are excessively steep and are not usable until they can be re-graded to minimal slopes with additional natural wall (or handrail) supports.



Photo 8

The informal trail between the back of Hurd Field and the Reservoir Trail at the spillway bridge is particularly hazardous and does not provide an accessible connection between the two sections of this multi-use facility. (Photo 9)



Photo 9



Signage

While the trails are still not through-accessible, a best practice recommendation is to install signage cautioning users about areas where graded trail is steep and presents uneven surface conditions.

The sign explaining the EPA Porous Pavement project at the Drake parking lot; and the Map installation at the Lowell St. Trail entry point do not provide accessible clear ground approach and viewing conditions due to mounting heights

Bulletin Boards

The Bulletin Board at the Trail beginning near the Lowell Parking lot needs to include a clear ground surface approach path.

Recommendations

Recommendations, Capital Projects

Approach & Entrance

Crosswalk and Curb Ramps

At Westmoreland Ave, add an accessible crosswalk with perpendicular ramps crossing Lowell St. near the "A" entrance or at West Court Terrace.

At Drake Rd/ Mass. Ave intersection, add crosswalk and compliant ramps to cross Massachusetts Ave from nearby public transit stop (Massachusetts Ave. @ Paul Revere Road).

For additional information, please refer to 2010 ADA Standards for Accessible Design: Accessible Routes for Accessible Routes and Curb Ramps.

Sidewalk

Lowell St: Replace sidewalk panels that have gaps, uneven terrain and cross slopes exceeding 2.08% along the sidewalk adjacent to Lowell St. pedestrian entry points.

Drake Road: Evaluate existing sidewalk panels from and replace panels with cross slopes exceeding 2.08%.

For additional information, please refer to 2010 ADA Standards for Accessible Design: Accessible Routes and Accessible Routes, Site Arrival Points and Accessible Routes for Accessible Routes and Curb Ramps.

Points of Entry

Cut and fill, re-grade and ramp the hilly path between the spillway bridge and the back of Hurd Field to provide a connecting secondary path with minimal run and cross slopes. Consider adding small wall or handrail supports where terrain exceeds 5% run slope.

For additional information, please refer to 2010 ADA Standards for Accessible Design: Accessible Routes and Accessible Routes, Site Arrival Points and Accessible Routes.

Recommendations, Without Much Difficulty or Expense

Approach & Entry

Parking

Re-grade and restripe Lowell St. lot. Provide at least 2 accessible spaces, 1 should be a vanaccessible space.

Points of Entry

Lowell entry: Modify vehicle off-limits boulder placement to provide a consistently level and smooth approach and entry point onto Reservoir Trail.

For additional information, please refer to 2010 ADA Standards for Accessible Design: Accessible Routes and Accessible Routes, Site Arrival Points and Accessible Routes for Accessible Routes and Curb Ramps.

Access to Facility Areas

Interior Walkways

from Drake parking lot: Provide an accessible path connection from accessible parking spaces to connect to perimeter of field playing areas, team seating areas at both ball fields, bleachers, fountain and portable restroom. Add a clear level ground space of at least 36 inches width and 48 inches length at seating and bleacher area, and in front of fountain controls.

Long-range: When back of Hurd Field entry point is made accessible, this accessible path connection needs to extend to that entry point.

For additional information, please refer to 2010 ADA Standards for Accessible Design: Accessible Routes.; and Scoping Requirements: Accessible Routes for within a Site

Access to Elements

Benches/ Passive Recreation

Best Practice Recommendation: At one stone bench viewing point, provide a level, clear approach and seating location with at least a 36 in. width and 60-inch depth additional clear

viewing space. Remove edging from behind stone bench and reroute it to front of viewing area.

For additional information, please refer to 2010 ADA Standards for Accessible Design: Accessible Routes; and Building Blocks: Clear Floor or Ground Space; and Scoping Requirements: Accessible Routes for within a Site.

Signage, Bulletin Board

Create clear level ground surface connections with at least 36 in. width and within at least 5 feet of all posted and installed information along trail and at entry points to facility.

For additional information, please refer to 2010 ADA Standards for Accessible Design: Accessible Routes; and Building Blocks: Clear Floor or Ground Space; and Scoping Requirements: Accessible Routes for within a Site.



Reservoir Beach

Located at the Arlington-Lexington line on the North end of town, **Reservoir Beach** features a sandy beach beside a chlorinated and filtered pool built into the Arlington Reservoir. Open during the summertime, this facility also includes one playground with separate zones of play structures and a building with concessions and partially accessible toilet rooms.

An unpaved parking lot off of Lowell Street is located on the South edge of the site. A trail that circles the reservoir connects to the beach on the North edge of the site.

Location:

250 Lowell Street, Arlington Reservoir

Year Built:

Unknown

Known Renovations since 1991:

Unknown

Primary Function Areas Surveyed:

- Beach
- Playground (sand)
- Building with Concessions and Toilet Rooms

Public Programs:

Open 10 a.m. to dusk in June, July, and August



crosswalks at the intersection of Lowell Street and West Court Terrace, neither is accessible because level top landings are not provided.

Issues

Approach and Entrance

Crosswalks and Curb Ramps

Along Lowell Street, three pedestrian crosswalks lead to the points of entry to this facility. At the intersection of Lowell Street and Westmoreland Avenue, no curb ramp is provided on the East side of Lowell Street and the curb ramp on the opposite side of the street is not accessible because a level top landing is not provided. Although curb ramps are provided on both ends of two highly visible



Sidewalks

On the North side of the site, a fire hydrant, vegetation, and a deteriorated driveway obstruct the sidewalk along Lowell Street.

All of the issues described above negatively affect the pedestrian approach to this facility from the nearby public transit stops at Lowell Street.

Parking

This facility has a large unpaved parking lot off of Lowell Street. Although two *ad hoc* spaces designated as accessible are provided near the gated entrance to the beach, they do not meet any of the minimum requirements for accessibility.



Additionally, a small parking lot on the Northeast corner of the site is restricted to residents with a reservation of the playground and picnic table for birthday parties. However, no accessible parking spaces are provided.



Points of Entry

This facility has two points of entry along Lowell St. that are open to the public and lead into the unrestricted public parking lot.

Along Lowell Street, both asphalt driveways that lead into this parking lot are also used for pedestrian access. The asphalt driveway closest to the beach is in poor condition and has excessive slopes (20%).

There is also an at-grade point of entry located off of the trail on the North edge of the site near the playgrounds. This entry point is closed during the summertime while the beach is in operation.



From the public parking lot, there is a gated entry point to the beach. This gate is missing a smooth surface or kickplate hardware on the bottom ten inches of the gate.

An additional point of entry along Lowell Street leads to the restricted parking lot on the Northeast corner of the site.



A sand path is provided along the entire facility. This path is not accessible because it is uneven and unstable, especially near benches and trees. Although a concrete walkway is provided near the water's edge, it is not connected to an accessible route.

Additionally, a concrete walkway adjacent to the building has excessive cross slopes (6%).



Play Areas

One large sandy area contains three separate zones of play structures. Although an accessible route is provided to the large play structure, the transition between stone path and rubber surface is in poor condition. (Photo 7)

No accessible route is provided to the swingset and the small play structure. (Photos 8 and 9)

Access to Elements



Tables

One picnic table is provided near the playground; however, it is not accessible because it does not provide the required knee clearance for people using wheeled mobility devices and is not located along an accessible route.

Benches

Several benches are provided through this facility. They can found along the sand path and trees, within the grassy knoll near the fence on Lowell Street, within the playground, and near the water's edge. The benches are not accessible because they do not adjoin an accessible route.



Concession Counter

Located in the building near the playground, a concession counter is not accessible because it is too high (42" above the ground). (Photo 12)

Toilet Rooms

One set of multi-user toilet rooms (one for each gender) are also located in the building near the playground. Although there has been an attempt to increase accessibility in these toilet rooms, they are not fully accessible because:

- ADA-compliant signs are not provided outside the toilet rooms;
- Lavatories have unprotected pipes underneath them;
- Accessible toilet stalls are provided; however, self-closing hinges of doors are malfunctioning, coat hooks are too high (68" above the floor), and side grab bars are too low (31" above the floor);
- Changing stations are too high (42" above the floor);
- Changing stalls are provided but none are accessible;
- Fire alarms are not provided;
- Outdoor showers are located adjacent to the toilet rooms but none are accessible.



Recommendations

Recommendations, Capital Projects

Approach & Entrance

Crosswalks and Curb Ramps

Install one curb ramp at the intersection of Lowell Street and Westmoreland Avenue and repair the curb ramps at the intersection of Lowell Street and Westmoreland Avenue and at the intersection of Lowell Street and West Court Terrace (total of 3 curb ramps).

For additional information, please refer to 2010 ADA Standards for Accessible Design: Accessible Routes for Accessible Routes and Curb Ramps.

Sidewalks

Repair a section of the sidewalk along Lowell Street on the North side of the site (about 25 feet).

For additional information, please refer to 2010 ADA Standards for Accessible Design: Accessible Routes.

Parking

Confirm the total number of parking spaces and provide the required parking spaces near the entrance to the beach. At a minimum, pave the area of the parking lot where the accessible parking spaces are located as well as the accessible route between the parking spaces and the beach. Additionally, provide at least one van-designated space at the restricted parking lot on the Northeast corner of the site.

For additional information, please refer to 2010 ADA Standards for Accessible Design:

General Site and Building Elements for Parking.

Points of Entry

Convert the steep vehicular driveway closest to the beach into an accessible pedestrian entry point by re-grading it so that running slopes are no greater than 5% and cross slopes are no greater than 2%. Alternatively, pave the entire parking lot and provide an accessible route between the driveway farthest from the beach and the point of entry to the beach.

For additional information, please refer to 2010 ADA Standards for Accessible Design: Accessible Routes.

Recommendations, Without Much Difficulty or Expense

Approach & Entrance

Points of Entry

Install an ADA-compliant latch and kickplate at the gate at the entrance to the beach.

For additional information, please refer to 2010 ADA Standards for Accessible Design: Accessible Routes for Accessible Routes.

Access to Facility Areas

Interior Walkways

Provide an accessible route between the parking lot, the building, the ramp at the water's edge, all zones of the playground, and the entry point at the trail (about 775 feet). Rebuild the concrete walkway adjacent to the building so that slopes are no greater than 2%.

For additional information, please refer to 2010 ADA Standards for Accessible Design: Accessible Routes.

Play Areas

Repair the transition between stone path and rubber surface at the large play structure and install an accessible walkway between points of entry and the swingset and the small play structure. The accessible route to these play areas can adjoin the new accessible walkway through the facility.

For additional information, please refer to 2010 ADA Standards for Accessible Design: Accessible Routes.

Access to Elements

Tables

Replace the picnic table near the playground with an ADA-compliant amenity and extend the asphalt walkway to it (about 75 feet).

For additional information, please refer to 2010 ADA Standards for Accessible Design: Accessible Routes.

Benches

Relocate one of each type of bench to an accessible area or install an accessible walkway to them (about 50 feet).

For additional information, please refer to 2010 ADA Standards for Accessible Design: Accessible Routes.

Although not a requirement under the ADA, consider providing at least 50% with armrests, as benches are replaced (total of 10 benches).

Concession Counter

Lower the concession counter located in the building to 36" above the ground. Alternatively, provide an auxiliary counter with a maximum

height of 36" in close proximity to the concession counter, or provide equivalent facilitation. Equivalent facilitation may be provided in the form of a folding shelf attached to the main counter, an auxiliary table nearby, a clipboard made available to the public, or other means.

Toilet Rooms

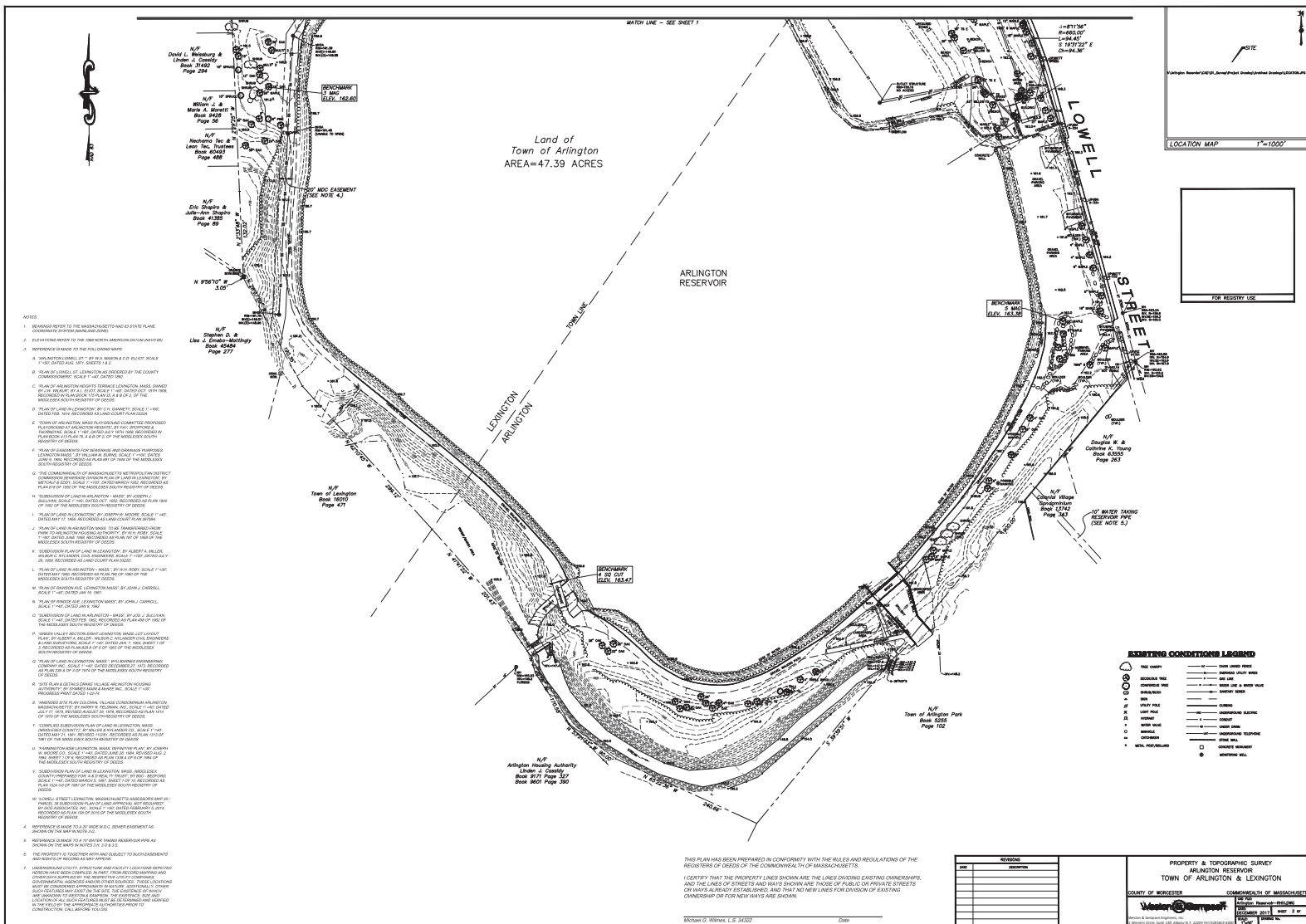
Make the following modifications to each multiuser toilet room:

- Install ADA-compliant signs alongside the doors to the toilet rooms;
- Protect the plumbing underneath the at least one of the lavatories in each toilet room;
- Inside each accessible toilet stall, adjust or replace the self-closing hinges of doors, lower the coat hook so that it is no higher than 48" above the floor, and raise the side grab bar so that is aligned with the rear grab bar;
- Lower the changing stations so that they are no higher than 34" above the floor;
- Install audible and visible fire alarms;
- At each outdoor shower, install a slip resistant wood decking so that it is flush with the adjacent concrete surface and retrofit one of the shower controls so that it is no higher than 48" above the ground.

For additional information, please refer to 2010 ADA Standards for Accessible Design: Plumbing Elements and Facilities for Toilet and Bathing Rooms.

[Note: no satellite image provided for Reservoir Beach Recommendations.]

APPENDIX J

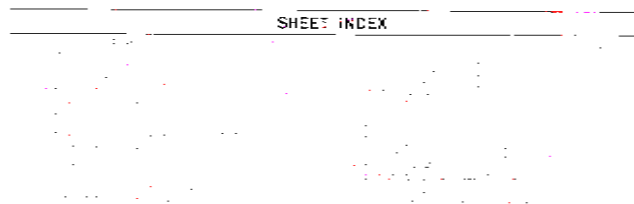
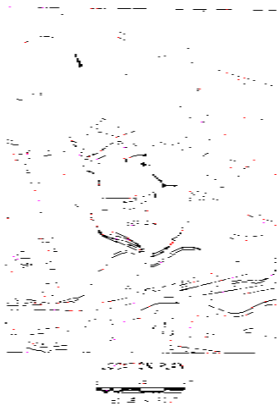


APPENDIX K

TOWN OF ARLINGTON, MASSACHUSETTS

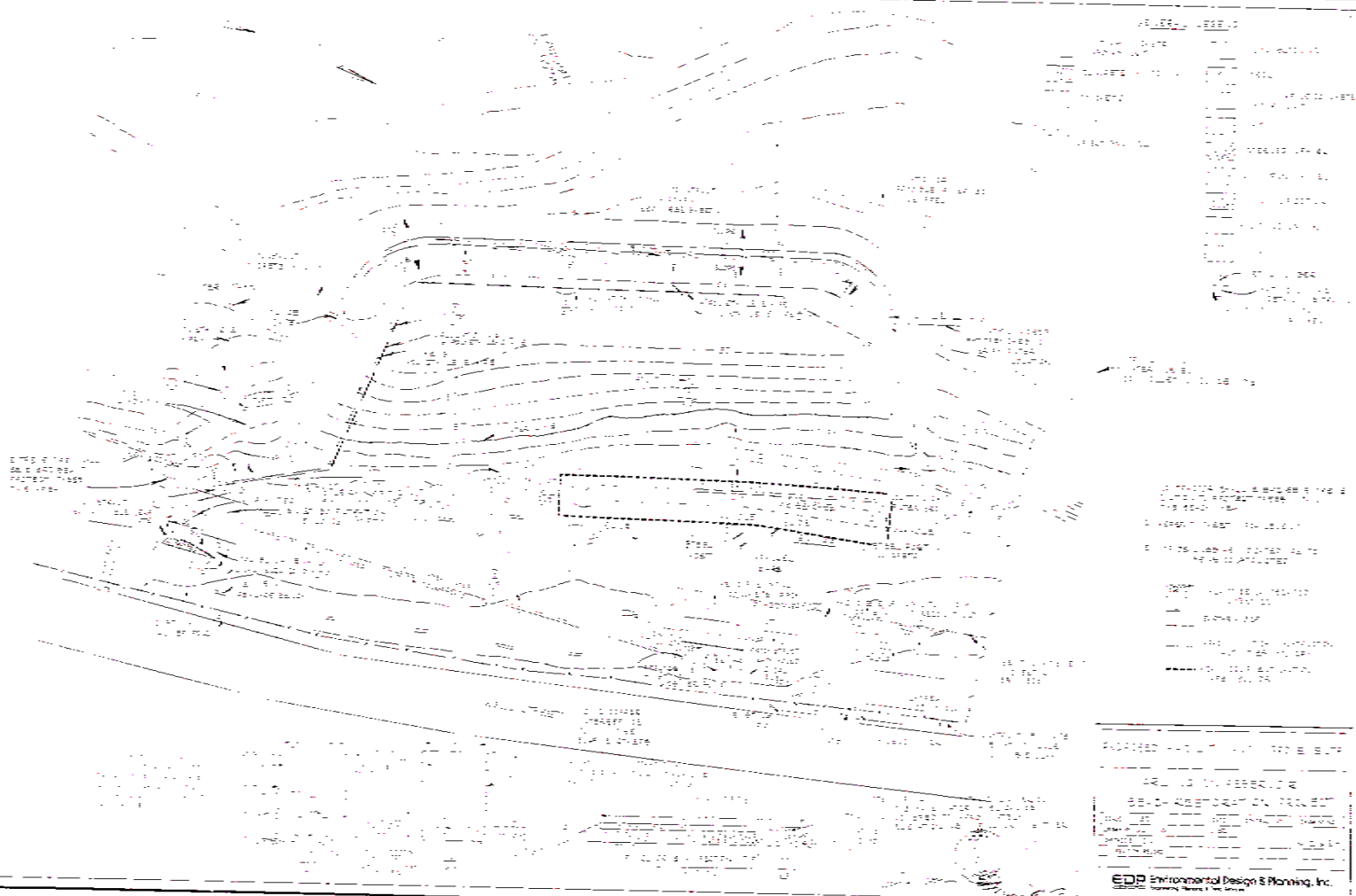
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THE UNITED STATES DEPARTMENT OF AGRICULTURE, AGRICULTURAL RESEARCH SERVICE
THE COMMODITY DEVELOPMENT BLOCK GRANT PROGRAM, AGRICULTURAL RESEARCH SERVICE

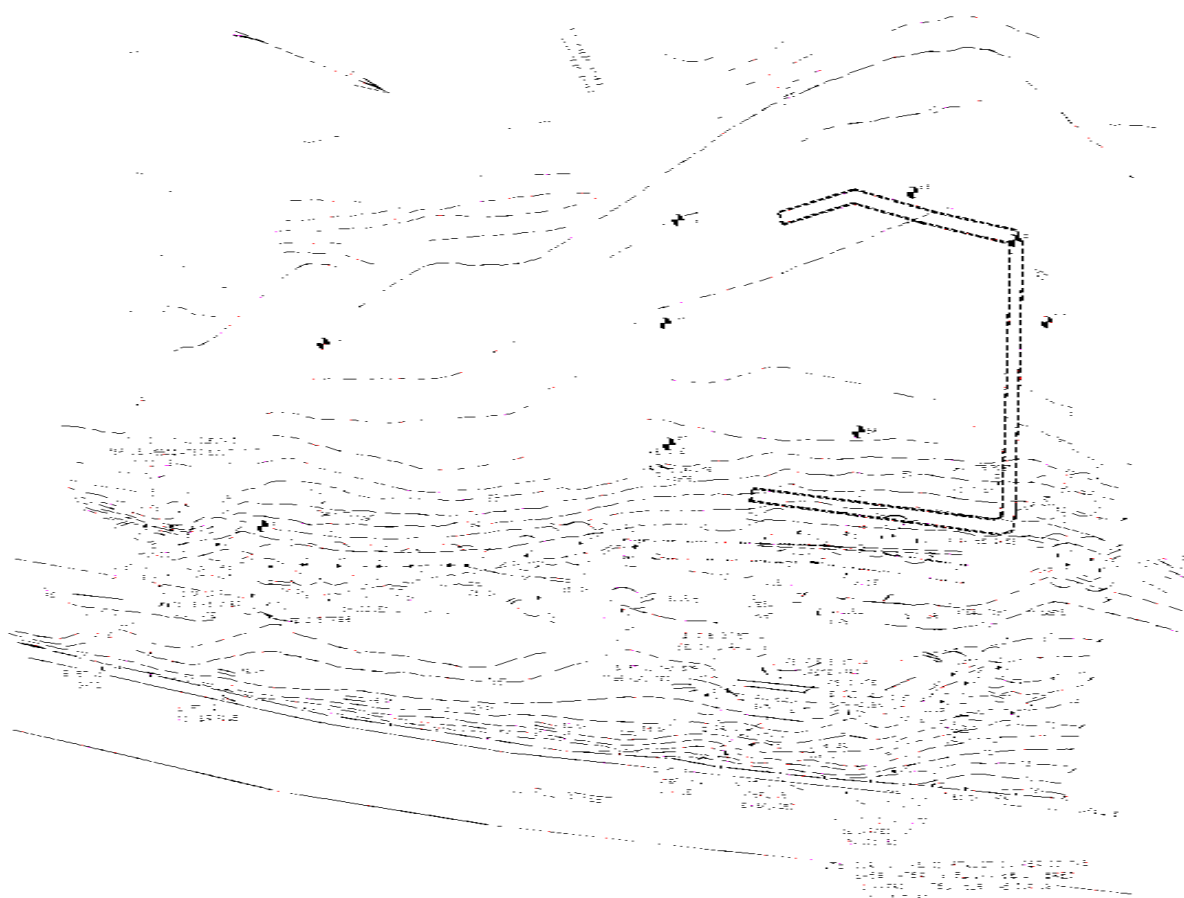
ARLINGTON RESERVOIR BEACH RESTORATION PROJECT



EDP Environmental Design & Planning, Inc.
Engineering, Planning & Field Services

Engineering, Planning & Field Services

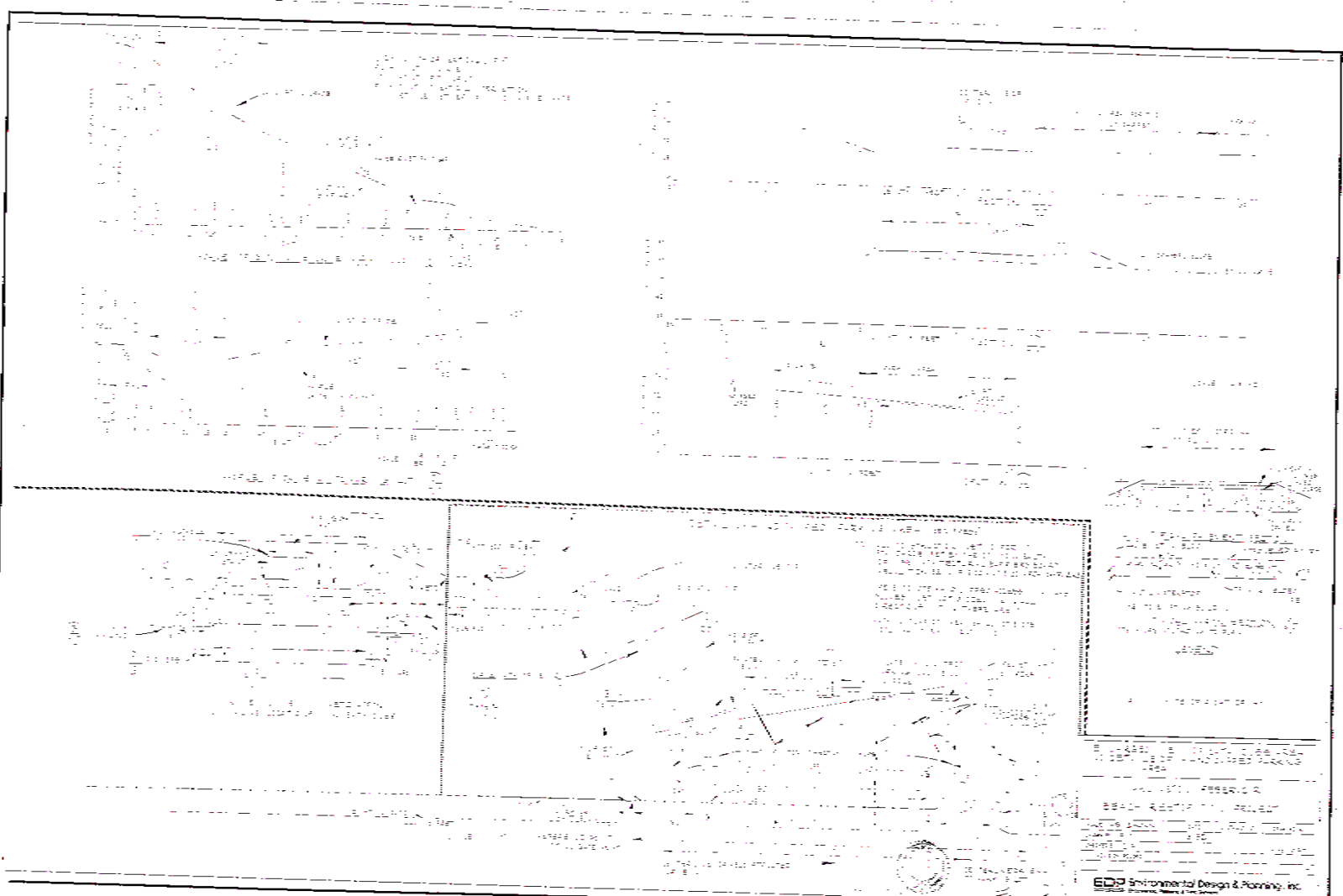




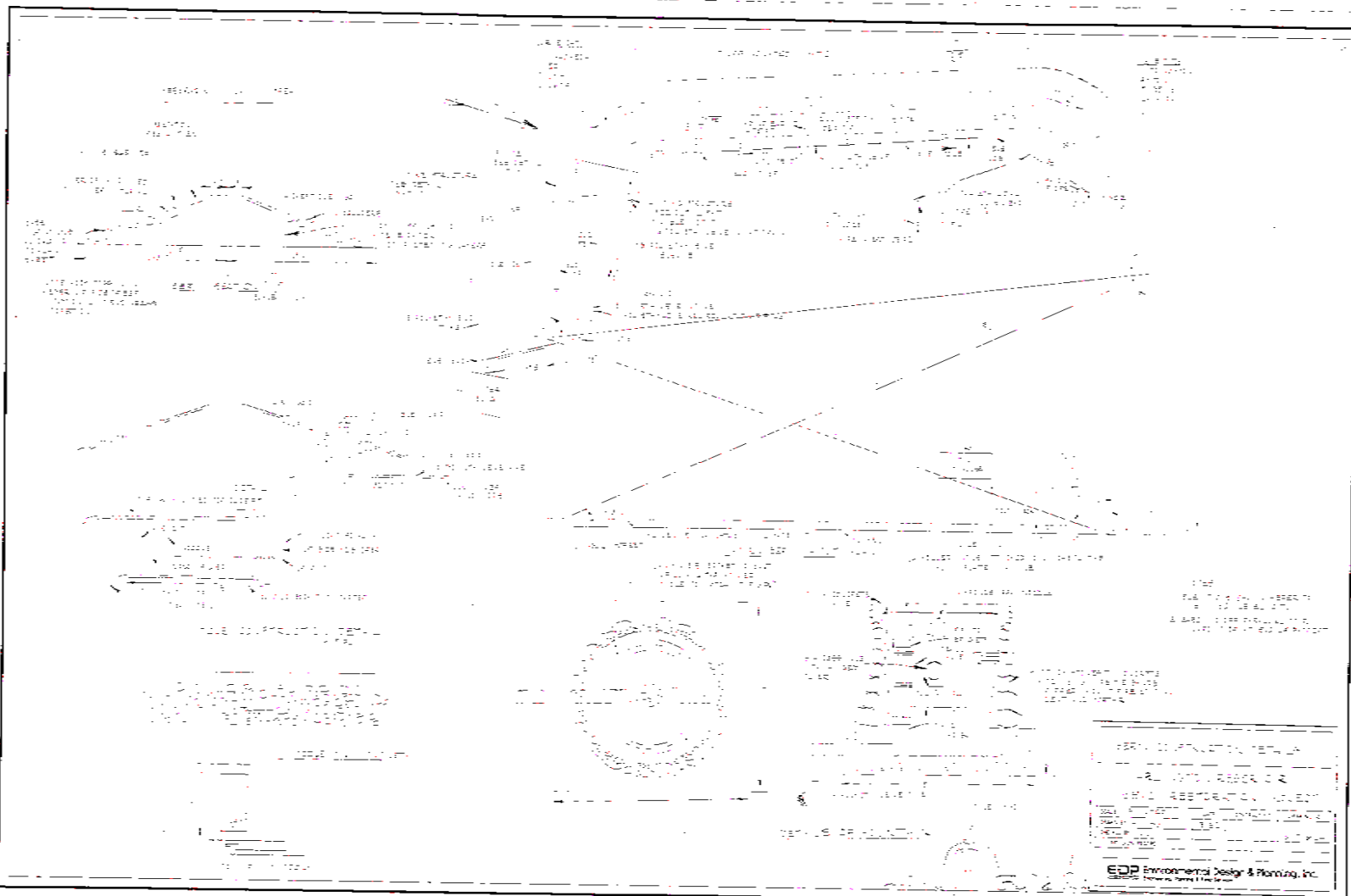
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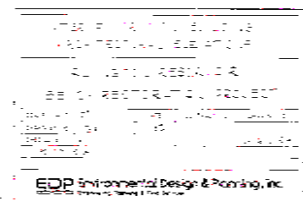
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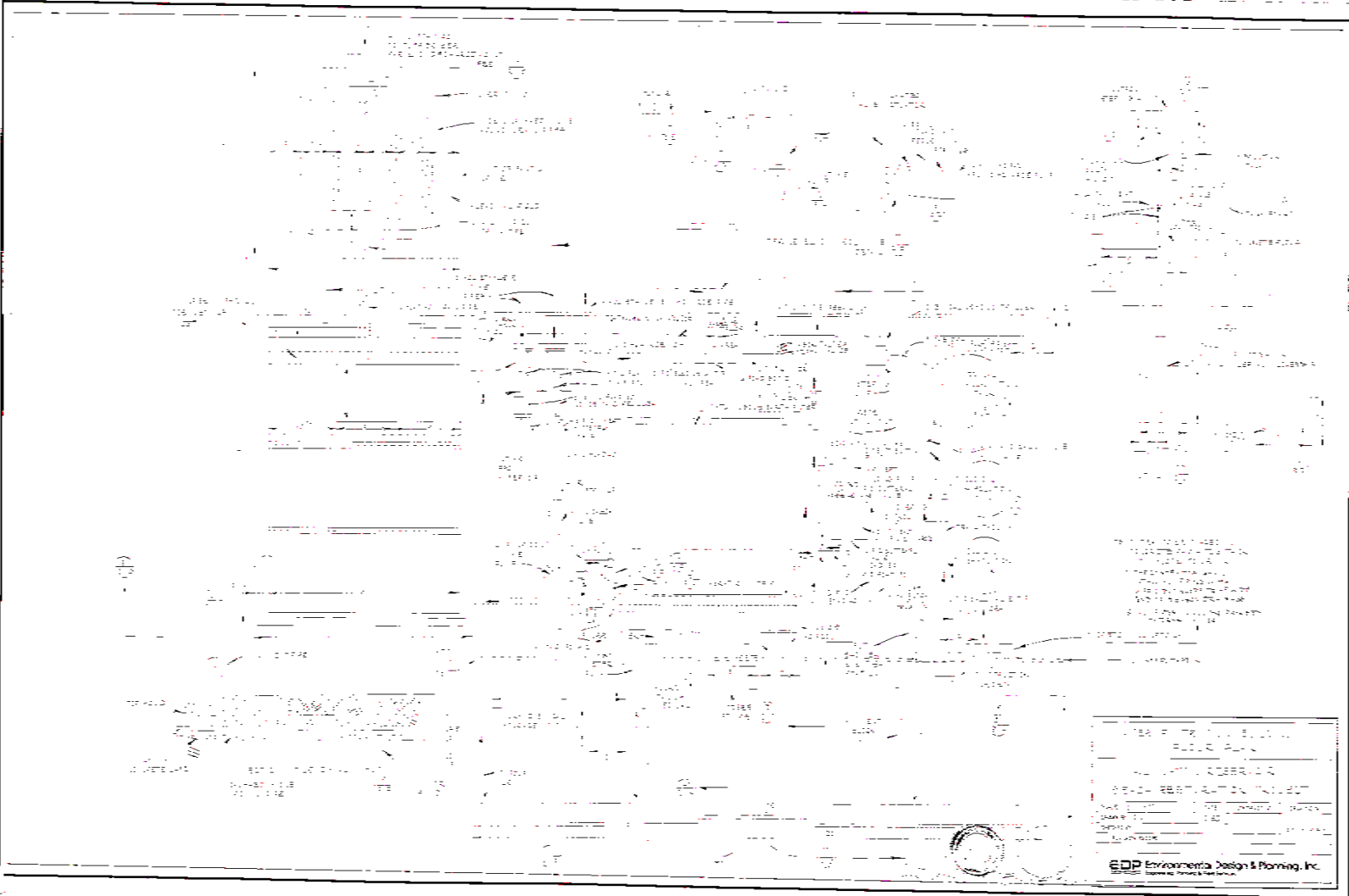
Environmental Design & Planning, Inc.





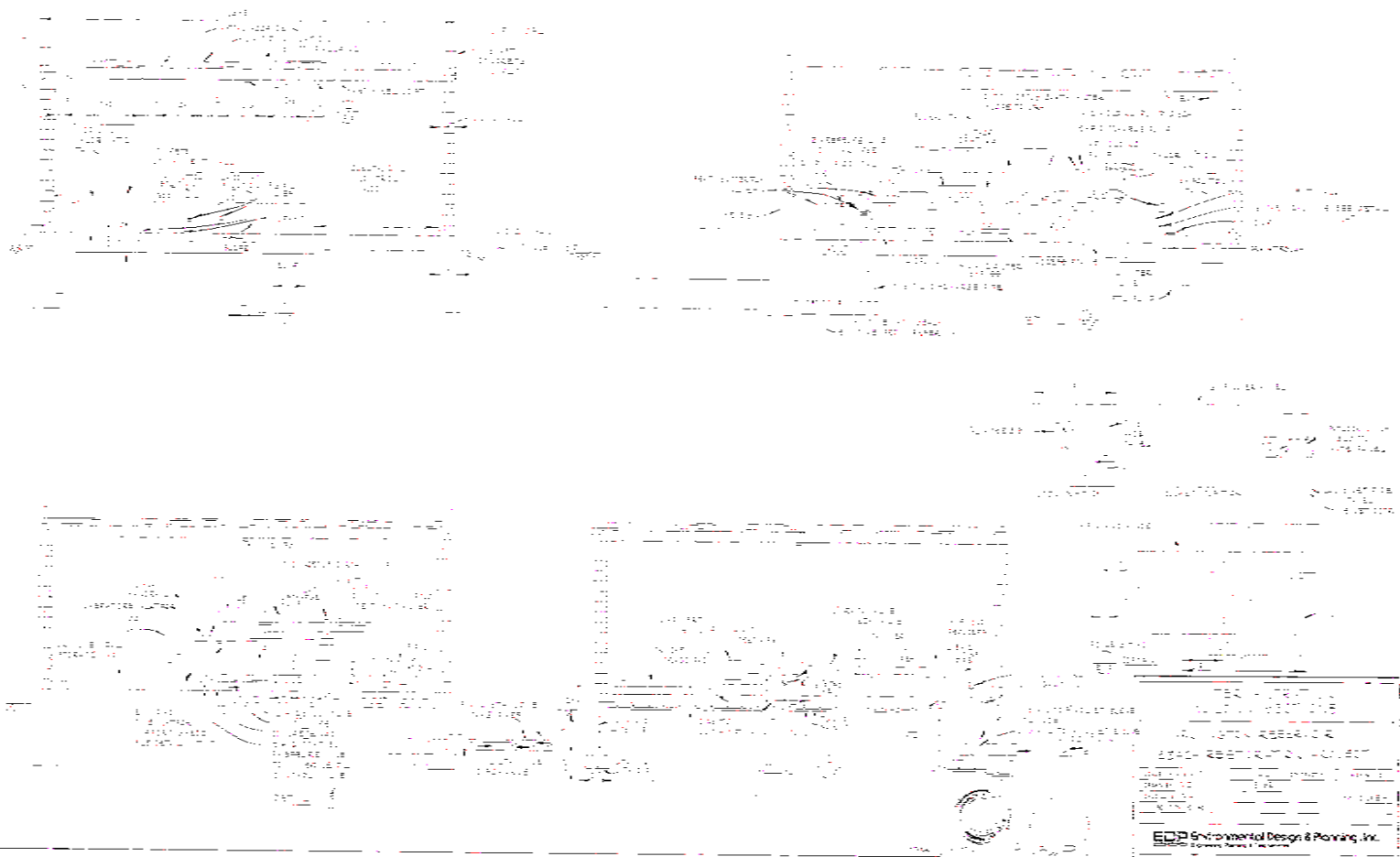


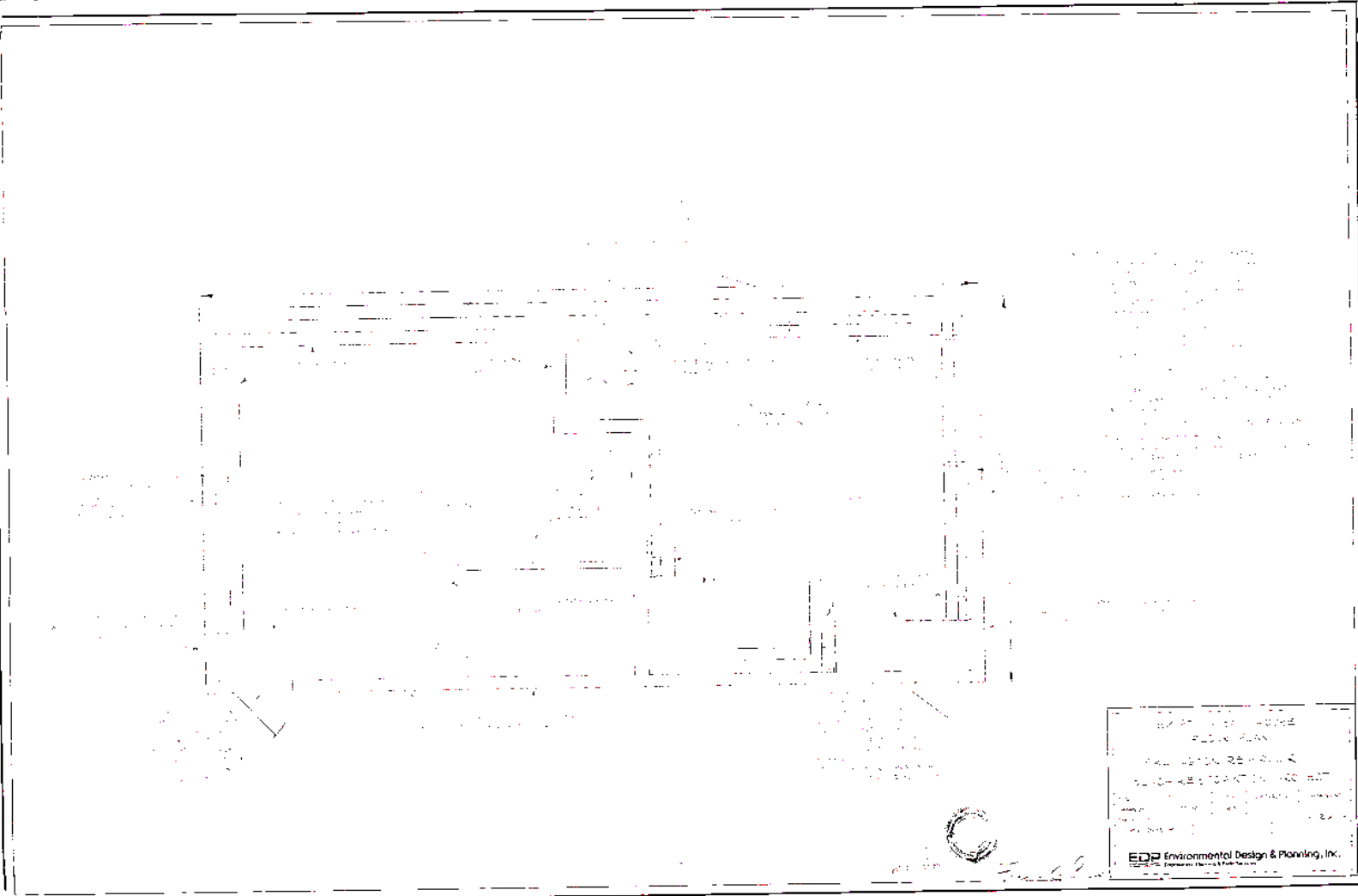
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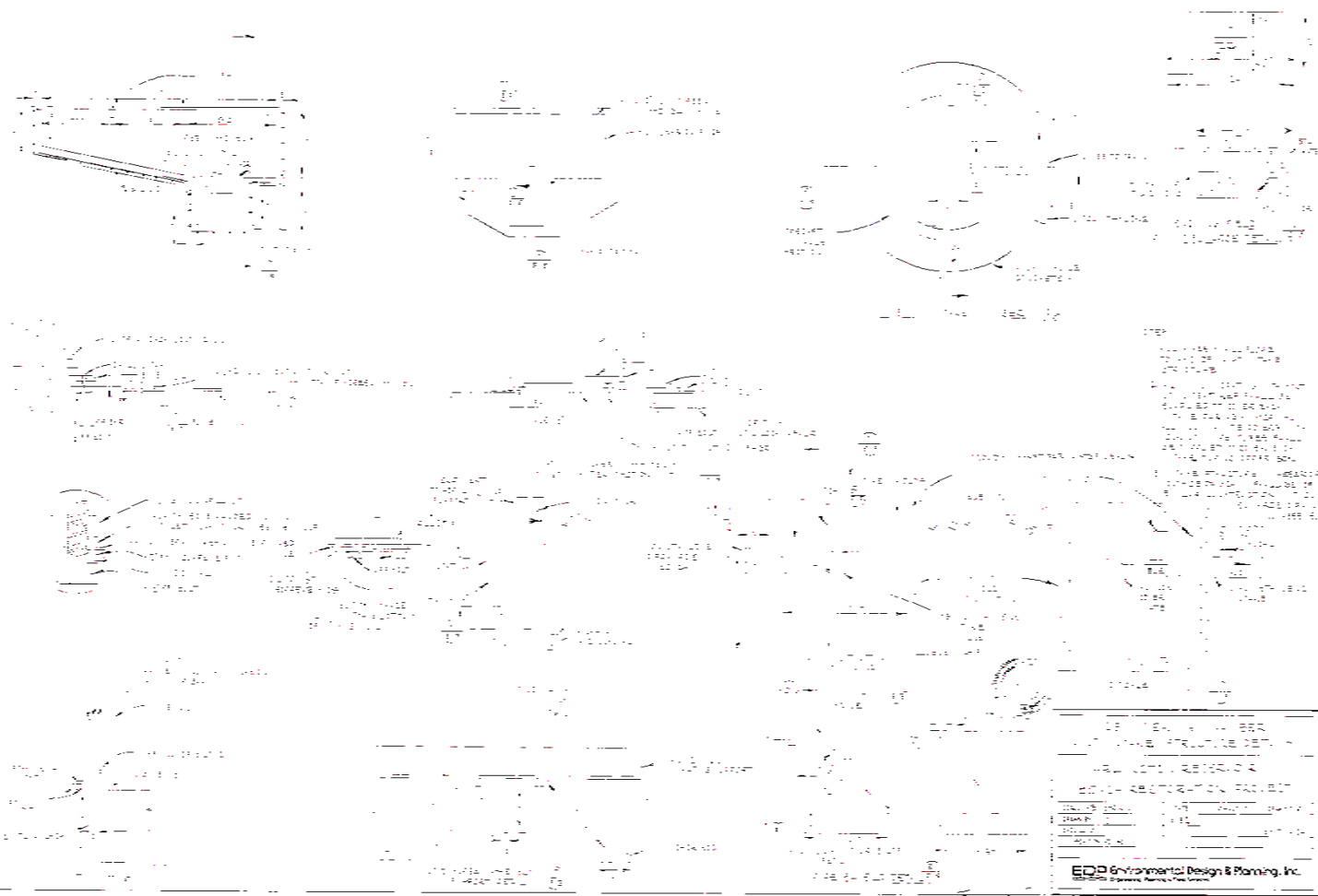
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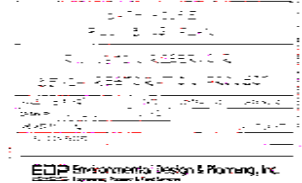


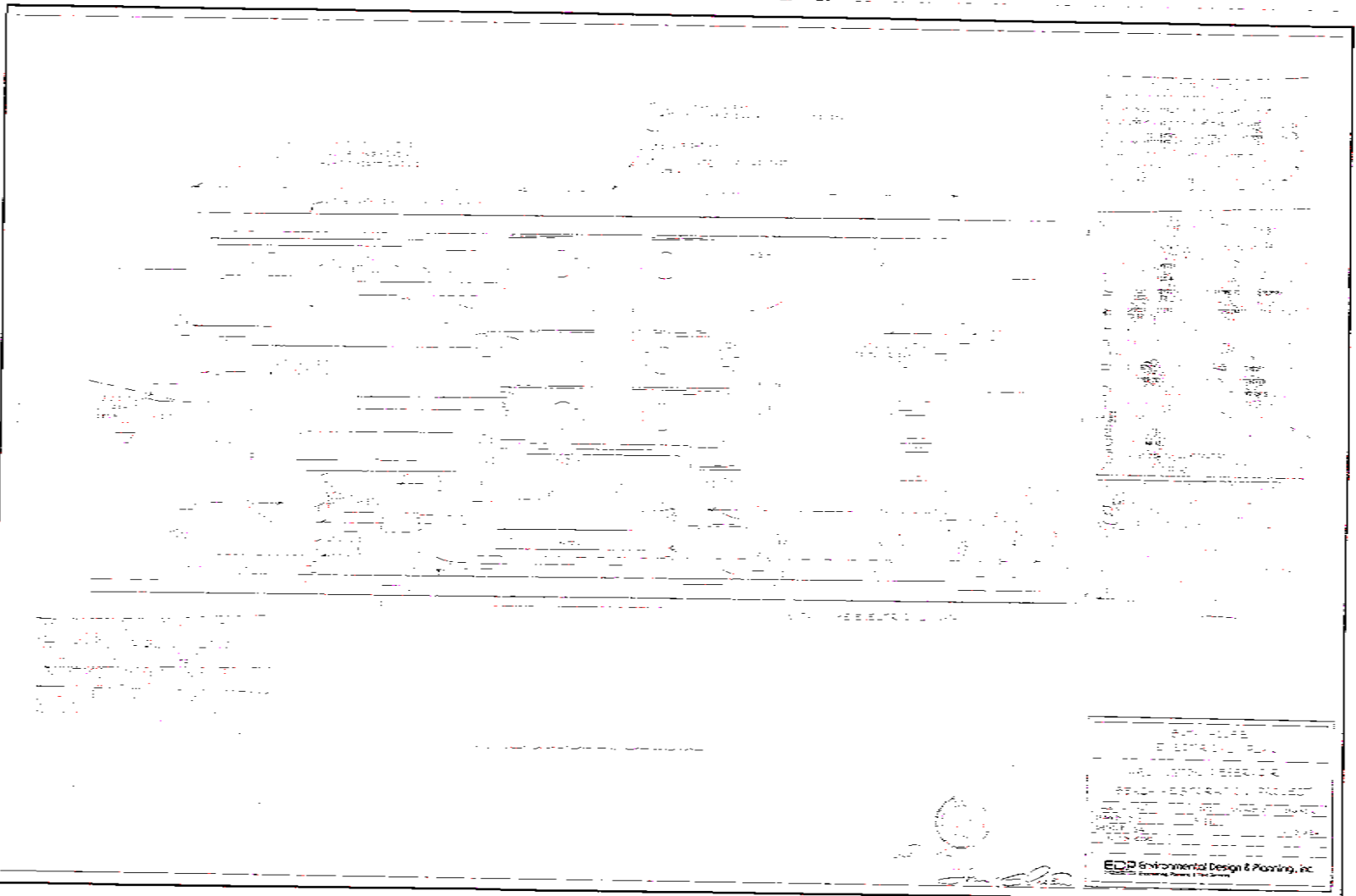
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A Division of Environmental Design & Planning, Inc.	

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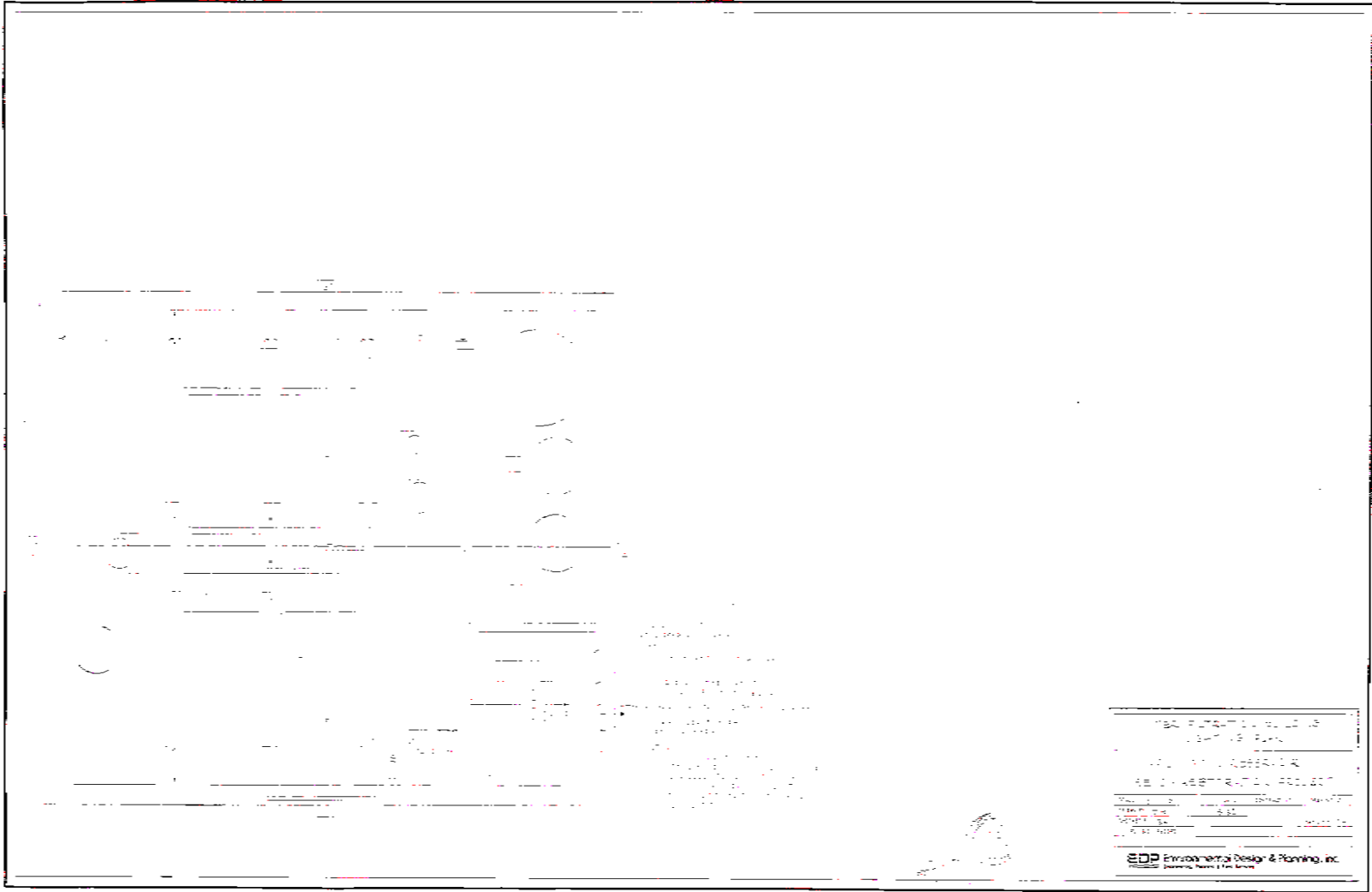
Figure 1. The effect of the concentration of the *Agrobacterium* suspension on the transformation efficiency of *Agrobacterium* strains. The concentration of the *Agrobacterium* suspension was 10⁶ cells/ml (a), 10⁷ cells/ml (b), 10⁸ cells/ml (c), and 10⁹ cells/ml (d). The concentration of the *Agrobacterium* suspension was 10⁶ cells/ml (a), 10⁷ cells/ml (b), 10⁸ cells/ml (c), and 10⁹ cells/ml (d).

The diagram illustrates the experimental design. It shows a sequence of events: a stimulus is presented, a response is recorded, and feedback is provided. This sequence is repeated for multiple trials. The stimuli are represented by boxes containing words or pictures, and the responses are represented by boxes containing letters (A, B, C, D). The feedback is represented by boxes containing 'Correct' or 'Incorrect'. The sequence is shown for a single trial and then repeated for multiple trials.

$\frac{1}{2} \times \frac{1}{2} = \frac{1}{4}$

EDD Environmental Design & Planning, Inc.

Keywords: consumer, planning, retail services



PROJECT INFORMATION			
PROJECT NAME			
PROJECT ADDRESS			
PROJECT DESCRIPTION			
DATE	BY	DATE	BY
10/10/10	EDP	10/10/10	EDP
EDP Environmental Design & Planning, Inc.			
Engineering, Planning & Construction Services			

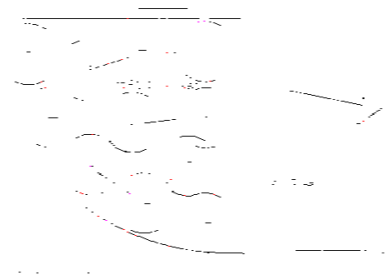


PLANTING PLAN FOR BERM STRUCTURE			
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PLANTING PLAN FOR BERM STRUCTURE
 STATION: 0+00 TO 0+100
 SCALE: 1" = 100'
 DATE: 10/1/2010
 EDD Environmental Design & Planning, Inc.
 10000 10th Avenue, Suite 100, San Diego, CA 92121
 (619) 594-1000
 www.eddenviro.com

Site Location Map



EDP Environmental Design & Planning, Inc.
10000 E. 1st Avenue, Suite 100
Denver, CO 80231
Tel: 303.733.1111
Fax: 303.733.1112
www.edpinc.com

APPENDIX L

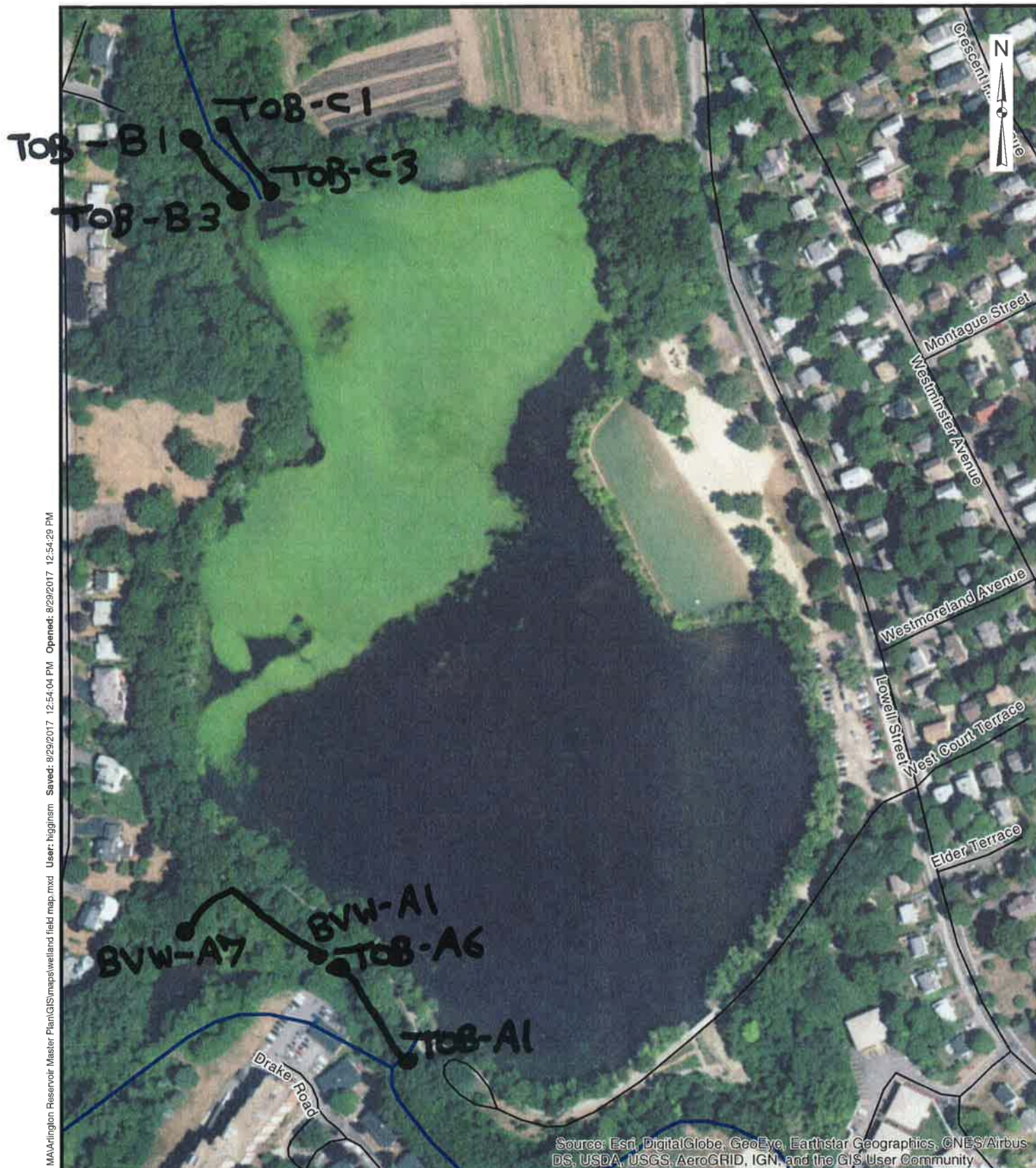


FIGURE 1
Arlington Reservoir
Arlington, Massachusetts
WETLANDS FIELD MAP



MassDEP Bordering Vegetated Wetland (310 CMR 10.55) Delineation Field Data Form

Applicant: Town of Arlington Prepared by: Weston & Sampson Project location: Arlington Reservoir DEP File #: _____
Check all that apply:

- ☐ Vegetation alone presumed adequate to delineate BVW boundary: fill out Section I only
- ☒ Vegetation and other indicators of hydrology used to delineate BVW boundary: fill out Sections I and II
- ☐ Method other than dominance test used (attach additional information)

Section I.

Vegetation		Observation Plot Number: 1	Transect Number: BVW-A2 (WET)	Date of Delineation: 8/28/17
A. Sample Layer & Plant Species (by common/scientific name)	B. Percent Cover (or basal Area)	C. Percent Dominance	D. Dominant Plant (yes or no)	E. Wetland Indicator Category*
Tree Layer:				
Red maple (Acer rubrum)	20	100	Yes	WET *
Shrub layer: none				
Cover layer:				
Skunk cabbage (Symplocarpus foetidus)	50	56	Yes	OBL *
Sensitive fern (Onoclea sensibilis)	20	22	Yes	FACW *
Purple loosestrife (Lythrum salicaria)	20	22	Yes	FACW+ *
Trailing layer:				
Riverbank grape (Vitis riparia)	10	100	Yes	FACW

* Use an asterisk to mark wetland indicator plants: plant species listed in the Wetlands Protection Act (MGL c.131, s.40); plants in the genus Sphagnum; plants listed as FAC, FAC+, FACW, FACW+, or OBL; or plants with physiological or morphological adaptations. If any plants are identified as wetland indicator plants due to physiological or morphological adaptations, describe the adaptation next to the asterisk.

Vegetation conclusion:

Number of dominant wetland indicator plants: 5 Number of dominant non-wetland indicator plants: 0

Is the number of dominant wetland plants equal to or greater than the number of dominant non-wetland plants? yes

If vegetation alone is presumed adequate to delineate the BVW boundary, submit this form with the Request for Determination of Applicability or Notice of Intent

Section II. Indicators of Hydrology

Other Indicators of Hydrology: (check all that apply & describe)

- ☒ Site Inundated: _____
- ☐ Depth to free water in observation hole: _____
- ☐ Depth to soil saturation in observation hole: _____
- ☐ Water marks: _____
- ☐ Drift lines: _____
- ☐ Sediment Deposits: _____
- ☐ Drainage patterns in BVW: _____
- ☐ Oxidized rhizospheres: _____
- ☐ Water-stained leaves: _____
- ☐ Recorded Data (streams, lake, or tidal gauge; aerial photo; other): _____
- ☐ Other: _____

1. Soil Survey

Is there a published soil survey for this site? yes
title/date: Middlesex County, MA
map number: MA017
soil type mapped: udorthents
hydric soil inclusions:

Are field observations consistent with soil survey? no
Remarks:

2. Soil Description

Horizon Depth Matrix Color Mottles Color

muck

Remarks:

3. Other:

Conclusion: Is soil hydric? yes

Vegetation and Hydrology Conclusion	
	Yes
Number of wetland indicator plants ≥ # of non-wetland indicator plants	X
Wetland hydrology present:	
Hydric soil present	X
Other indicators of hydrology present	X
Sample location is in a BVW	X

Submit this form with the Request for Determination of Applicability or Notice of Intent.

MassDEP Bordering Vegetated Wetland (310 CMR 10.55) Delineation Field Data Form

Applicant: Town of Arlington Prepared by: _Weston & Sampson_ Project location: Arlington Reservoir DEP File #: _____

Check all that apply:

- ☐ Vegetation alone presumed adequate to delineate BVW boundary: fill out Section I only
- ☒ Vegetation and other indicators of hydrology used to delineate BVW boundary: fill out Sections I and II
- ☐ Method other than dominance test used (attach additional information)

Section I.

Vegetation		Observation Plot Number: 2	Transect Number: BVW-A2 (UPL)	Date of Delineation: 8/28/17
A. Sample Layer & Plant Species (by common/scientific name)	B. Percent Cover (or basal Area)	C. Percent Dominance	D. Dominant Plant (yes or no)	E. Wetland Indicator Category*

Tree Layer:

Black locust (Robinia pseudoacacia) 70 100

Shrub layer: none

Yes FACU

Cover layer:

Staghorn sumac (Rhus typhina) 30 100

Yes UPL

Trailing layer: none

* Use an asterisk to mark wetland indicator plants: plant species listed in the Wetlands Protection Act (MGL c.131, s.40); plants in the genus Sphagnum; plants listed as FAC, FAC+, FACW-, FACW, FACW+, or OBL; or plants with physiological or morphological adaptations. If any plants are identified as wetland indicator plants due to physiological or morphological adaptations, describe the adaptation next to the asterisk.

Vegetation conclusion:

Number of dominant wetland indicator plants: 0

Number of dominant non-wetland indicator plants: 2

Is the number of dominant wetland plants equal to or greater than the number of dominant non-wetland plants? no

If vegetation alone is presumed adequate to delineate the BVW boundary, submit this form with the Request for Determination of Applicability or Notice of Intent

Section II. Indicators of Hydrology

Hydric Soil Interpretation

1. Soil Survey

Is there a published soil survey for this site? yes
title/date: Middlesex County, MA
map number: MA017
soil type mapped: udorthents
hydric soil inclusions:

Are field observations consistent with soil survey? yes
Remarks:

2. Soil Description

Horizon	Depth	Matrix Color	Mottles Color
A	0 – 12"	10YR 3/3	none
Remarks:			
dry soil			
Other:			

3. Other:

Conclusion: Is soil hydric? no

Other Indicators of Hydrology: (check all that apply & describe)

- Site Inundated: _____
- ☐ Depth to free water in observation hole: _____
 - ☐ Depth to soil saturation in observation hole: _____
 - ☐ Water marks: _____
 - ☐ Drift lines: _____
 - ☐ Sediment Deposits: _____
 - ☐ Drainage patterns in BWV: _____
 - ☐ Oxidized rhizospheres: _____
 - ☐ Water-stained leaves: _____
 - ☐ Recorded Data (streams, lake, or tidal gauge; aerial photo; other): _____
 - ☐ Other: _____

Vegetation and Hydrology Conclusion

Yes No

Number of wetland indicator plants
≥ # of non-wetland indicator plants

x

Wetland hydrology present:

Hydric soil present

x

Other indicators of hydrology present

x

Sample location is in a BWV

x

Submit this form with the Request for Determination of Applicability or Notice of Intent.

APPENDIX M

PHASE 1 IMPROVEMENTS		
	Unit Cost	Notes
DEMOLITION + SITE PREPARATION	\$ 20,000	
Temporary Construction Fence	\$ 5,000	
Tree Pruning, Clearing and Grubbing	\$ 5,000	
Misc. Pump Equipment Demolition	\$ 10,000	Demo of pump, filter, hydraulic system
PILOTING OF TRAIL + RESERVOIR PERIMETER IMPROVEMENTS	\$ 20,000	
Repair of Erosion Control Issues (1 location)	\$ 8,000	Incl. coir fascine and stakes, labor, new native plantings, and seeding of erosional areas
Removal of Invasive Plant Species	\$ 6,000	Incl. labor and restoration of 0.25 acre, seeding
FlexiPave (50 LF)	\$ 6,000	Assumes 6' width
PUMP EQUIPMENT REPAIR/REPLACEMENT	\$ 495,000	
New Filtration	\$ 250,000	
Renovate Suction System & Collector Tank System	\$ 100,000	
New Chemical Feed System	\$ 20,000	
Install UV Treatment	\$ 65,000	
New Inlet Delivery System	\$ 30,000	
New Skimming System	\$ 30,000	
PUMP BUILDING REPAIRS	\$ 138,600	
Structural	\$ 24,600	
Concrete Masonry Repair Allowance	\$ 10,000	
Masonry Sealer	\$ 4,600	
Steel Framing and Metal Deck Repair Allowance	\$ 10,000	Initial application only
Architectural - Interior	\$ 25,500	
Add Inside Walls to Reconfigure Space	\$ 13,500	Assumes add'1 28' wall to separate equipment, plus a single interior door, basic power & lighting, ventilation
New Door & Frame	\$ 2,000	
Prep & Paint Walls	\$ 6,000	
Prep & Paint Ceiling	\$ 4,000	
Architectural - Exterior	\$ 88,500	
Replace Roof	\$ 20,000	
New Double Door & Frame	\$ 4,000	
Clean & Repoint Masonry	\$ 20,000	
Outside Check In Area	\$ 25,000	Assumes post and beam with overhang
Prep & Paint Exterior CMU Block Walls	\$ 2,500	
Landscape Treatment along Building Face	\$ 17,000	
Construction Subtotal	\$ 673,600	
Construction Contingency (20%)	\$ 134,720	
Contractor Mobilization, Overhead & Profit (15%)	\$ 101,040	
Soft Costs (12%), including design, engineering and permitting	\$ 80,832	
PHASE 1 TOTAL	\$ 990,192	
PHASE 1 TOTAL SAY:	\$ 991,000	

Budget Estimate - May 7, 2018

NEXT PHASE IMPROVEMENTS

	Unit Cost	Notes
DEMOLITION + SITE PREPARATION	\$ 82,000	
Temporary Construction Fence	\$ 10,000	Assumes use of existing fencing and limited temp. fencing along trails
Tree Protection at Bathing Beach & Parking Lot Improvements	\$ 10,000	
Tree Protection at Trail Improvements	\$ 6,000	
Tree Stump Grinding (24")	\$ 2,000	
R&D Paving (Asphalt, Concrete, Gravel)	\$ 38,000	
R&D Fence	\$ 6,000	
Misc. Demolition	\$ 10,000	
REMAINING TRAIL + RESERVOIR PERIMETER IMPROVEMENTS	\$ 252,000	
Repair of Erosion Control Issues (17 locations)	\$ 63,000	Incl. coir fascine and stakes, labor, new native plantings, and seeding of erosional areas
Removal of Invasive Plant Species	\$ 29,000	Incl. labor and restoration of 2.54 acre, seeding and invasive root treatment
FlexiPave (750 LF)	\$ 90,000	Assumes 6' width
Trail Improvements	\$ 70,000	All pathways not FlexiPave
BATH HOUSE RENOVATIONS	\$ 370,300	
Structural	\$ 69,400	
Repair/ replace Existing Roof Sheathing	\$ 14,400	
Reinforce Roof Framing	\$ 15,000	
Provide Uplift Ties	\$ 8,000	
Concrete Masonry Repair Allowance	\$ 20,000	Add vertical reinforcing for uplift
Rebuilding Screen Walls	\$ 12,000	
Architectural - Exterior	\$ 120,400	
Replace Roof	\$ 16,500	
New Skylights	\$ 10,000	
Roof Trim	\$ 3,750	
Gutters	\$ 2,000	
Downspouts	\$ 1,200	
New Gable Louvers	\$ 2,500	
New Door & Frame	\$ 12,000	
Clean & Repoint Masonry	\$ 20,000	
Replace Entry Screens	\$ 6,200	
Demo/ Cut Service Window	\$ 5,000	
New Service Counter & Trim	\$ 2,500	
New Colling Shutter	\$ 3,500	
Add Inside Walls to Reconfigure Space	\$ 10,250	Assumes add'l 15' wall to expand concession area, plus basic power & lighting, ventilation
Landscape Treatment along Building Face	\$ 25,000	
Architectural - Interior	\$ 180,500	
New door & frame	\$ 3,000	
Prep & Paint Walls	\$ 9,000	
Prep & Paint Ceiling	\$ 6,000	
New WCs	\$ 30,000	
New Urinals	\$ 13,500	
New Lavatories	\$ 27,000	
New DW Heater	\$ 22,500	
Toilet Partitions & Screens	\$ 9,000	
Toilet Accessories	\$ 7,500	
Outdoor Shower Upgrades	\$ 10,000	
Exterior Lighting	\$ 6,000	
Interior Lighting	\$ 12,000	
Gas Service or Electric Upgrade	\$ 25,000	
PARKING LOT, FENCE & GATES	\$ 579,600	
Primary Parking Lot	\$ 490,000	
Perimeter Chain Link Fence	\$ 86,000	
Double Gates	\$ 3,600	
BOAT RAMP	\$ 9,400	
Earthwork	\$ 500	
Concrete Paving	\$ 8,900	Incl. gravel base
BATHING BEACH INFRASTRUCTURE IMPROVEMENTS (incl. sediment cleanout)	\$ 350,000	
Dredging of Sediment	\$ 50,000	
Exotic Vegetation Removals from Embankment	\$ 15,000	
Embankment Reinforcement	\$ 125,000	
Weir Construction	\$ 65,000	
Armoring of the Interior Embankment Walls	\$ 95,000	
INTERPRETIVE SIGNAGE	\$ 3,000	
Large Angled Sign and Post (3 @ 24"x36")	\$ 1,500	
Small Upright Sign and Post (6 @ 8"x10")	\$ 1,500	
ADDITIONAL RENOVATION CONSIDERATIONS		
Drop Off Area	\$ 29,100	
Earthwork	\$ 900	
New Drainage Piping & Structures	\$ 12,000	
Bituminous Concrete Paving - Porous	\$ 10,900	Incl. gravel base
Granite Curb	\$ 4,800	
Striping	\$ 500	
New Grilling Area at Concession	\$ 60,400	
Earthwork	\$ 1,300	
Concrete Paving	\$ 16,700	Incl. gravel base
Trash Receptacle/ Recycling	\$ 2,400	
Drinking Fountain with Bottle Filler	\$ 6,000	
Café Tables & Chairs	\$ 13,500	
Picnic Tables	\$ 11,300	Incl. 1 ADA table
Concrete Paving for Picnic	\$ 7,500	
Outdoor Grills	\$ 3,000	
Playground	\$ 225,000	
Earthwork	\$ 2,500	
Concrete Pathway	\$ 2,500	Incl. gravel base
PIP Rubber Play Surfacing	\$ 89,000	Incl. gravel base
Steel Edger	\$ 4,000	
Play Equipment	\$ 127,000	

Pathway Improvements	\$	173,200	
Earthwork	\$	6,900	
Concrete Paving	\$	94,000	Incl. gravel base
Stabilized Stone Dust	\$	19,000	Incl. gravel base; not incl. edge restraint
Accessibility Improvements	\$	20,000	
Detectable Warning Mats at Curb Cuts	\$	2,000	
FlexiPave Pathway Connection	\$	13,000	
Concrete Stairs	\$	18,300	
Overlook Seating	\$	13,500	
Earthwork	\$	400	
Stabilized Stone Dust	\$	3,100	Incl. gravel base; not incl. edge restraint
Benches	\$	10,000	
Beach Volleyball	\$	2,000	
Beach Sand	\$	1,500	
Volleyball Net	\$	500	
New Tree & Shrub Planting	\$	100,800	
New Native Deciduous Trees	\$	30,000	
New Native Shrub Planting	\$	34,000	
New Native Perennial Plug Planting	\$	14,800	
Tree Grates at Plaza	\$	3,800	
Pine Bark Mulch	\$	5,200	
Loam & Seed	\$	13,000	
Pruning of Existing Trees	\$	20,000	
Beach Sand Replenishment	\$	32,000	
Entry Plaza	\$	38,500	
Earthwork	\$	1,700	
Concrete Paving	\$	31,100	Incl. gravel base
Trash Receptacle/ Recycling	\$	1,200	
Bike Racks	\$	4,500	
Pavilion/ Shade Structure	\$	87,400	
Earthwork	\$	400	
Concrete Pad	\$	7,000	Incl. gravel base
Pavilion Structure	\$	80,000	
Terraced Seating	\$	79,800	
Earthwork	\$	500	
Concrete Seat Walls	\$	79,300	
Construction Subtotal	\$	2,508,000	
Construction Contingency (20%)	\$	501,600	
Contractor Mobilization, Overhead & Profit (15%)	\$	376,200	
Soft Costs (12%), including design, engineering and permitting	\$	300,960	
NEXT PHASE TOTAL	\$	3,686,760	
NEXT PHASE TOTAL SAY	\$	3,687,000	
TOTAL PROJECT COST	\$	4,678,000	

APPENDIX N

June 26, 2018

TO: Jon Marshall
Director, Parks and Recreation
Town of Arlington

DESIGN STUDIO
85 Devonshire Street, 3rd Floor, Boston, MA 02109
Tel: 617.412.4480

FROM: Cheri Ruane, RLA

Re: **Funding Scenarios for Arlington Reservoir Master Plan**

Please append this memo to the DRAFT of the Arlington Reservoir Master Plan document that you will be distributing tonight. The information below should be inserted at the bottom of Page 84.

As discussed the Town has committed \$2M in capital funds for the next round of improvements at The Res. Based on opinions of probable cost for improvements, soft costs, and contingencies, the total estimate for the next phase of work rounds up to \$3.45M leaving a delta of \$1.45M in needed funding.

Through our committee meetings and review of grant programs included in the Master Plan document we offer the following potential funding scenario to complete the financing package. Keep in mind that the Town's \$2M commitment would provide any and all matching funds required by the summary below:

For general park improvements including access to water, active and passive recreation est. \$400k:

Parkland Acquisition and Renovations for Communities (PARC)	Improvements to existing parks	\$400,000	Reimbursement program	Mid July	
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For improvements to conservation areas, erosion control and pathway improvements est \$150k:

Massachusetts Land and Water Conservation Fund	Development and renovation of parks, recreation and conservation areas	unmin. \$10,000; max \$200,000	Reimbursement program	Early June	
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For improved playground area and active recreation amenities est \$750k:

Landscape Partnership Program	To build a park or playground	\$1,250,000	Up to 50% of total eligible project costs; reimbursement program	Late Fall	
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For erosion control, cleaning of existing outfalls, and aquatic vegetation management est. \$50k:

604b Water Quality Management Planning	Green infrastructure projects that manage wet weather to maintain or restore natural hydrology.	\$50,000	Reimbursement program.	Early March	
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For trail improvements, interpretive signage and connections to larger town trail networks est \$100k:

Greenways and Trails Program/ Recreational Trails Program	Maintenance and restoration of existing recreational trails; development and rehabilitation of recreational trailside and trailhead facilities	\$5,000 to \$50,000; \$100,000 for larger projects	Must be at least 20% of the total project value.	mid Feb	
Recreational Trails Program - Education Grants	Training on trail accessibility and sustainability; Training that promotes safety or environmental protection related to recreational trails. Partnering with youth organizations, corps or individual volunteers are highly encouraged!	\$8,000 to \$10,000	Must be at least 20% of the total project value.	Rolling	

GRANT	AWARD	MATCH
PARC GRANT	\$400K	\$280K
MLWCF	\$150K	
Landscape Partnership	\$750K	\$375K
604b Water Quality	\$ 50K	
Greenways / Trails	\$ 90K	\$ 18K
Recreational Trails	\$ 10K	\$ 2K
	\$1.45M	\$675K (from the \$2M capital improvement budget)